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SELECTED WATER RESOURCES ABSTRACTS

VOLUME 12, NUMBER 23
DECEMBER 1, 1979

W79-09831 – W79-10080
CODEN: SWRABW

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U.S. DEPARTMENT OF THE INTERIOR
OFFICE OF WATER RESEARCH AND TECHNOLOGY
WATER RESOURCES SCIENTIFIC INFORMATION CENTER

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SELECTED WATER RESOURCES ABSTRACTS

A Semimonthly Publication of the Water Resources Scientific Information Center, Office of Water Research and Technology, U.S. Department of the Interior

VOLUME 12, NUMBER 23
DECEMBER 1, 1979

W79-09831 -- W79-10080

The Secretary of the U.S. Department of the Interior has determined that the publication of the periodical is necessary in the transaction of the public business required by law of this Department. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through August 31, 1983.

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

FOREWORD

Selected Water Resources Abstracts, a semimonthly journal, includes abstracts of current and earlier pertinent monographs, journal articles, reports, and other publication formats. The contents of these documents cover the water-related aspects of the life, physical, and social sciences as well as related engineering and legal aspects of the characteristics, conservation, control, use, or management of water. Each abstract includes a full bibliographical citation and a set of descriptors or identifiers which are listed in the **Water Resources Thesaurus.** Each abstract entry is classified into 10 fields and 60 groups similar to the water resources research categories established by the Committee on Water Resources Research of the Federal Council for Science and Technology.

WRSIC IS NOT PRESENTLY IN A POSITION TO PROVIDE COPIES OF DOCUMENTS ABSTRACTED IN THIS JOURNAL. Sufficient bibliographic information is given to enable readers to order the desired documents from local libraries or other sources.

Selected Water Resources Abstracts is designed to serve the scientific and technical information needs of scientists, engineers, and managers as one of several planned services of the Water Resources Scientific Information Center (WRSIC). The Center was established by the Secretary of the Interior and has been designated by the Federal Council for Science and Technology to serve the water resources community by improving the communication of water-related research results. The Center is pursuing this objective by coordinating and supplementing the existing scientific and technical information activities associated with active research and investigation program in water resources.

To provide WRSIC with input, selected organizations with active water resources research programs are supported as "centers of competence" responsible for selecting, abstracting, and indexing from the current and earlier pertinent literature in specified subject areas.

Additional "centers of competence" have been established in cooperation with the Environmental Protection Agency. A directory of the Centers appears on the inside back cover.

Supplementary documentation is being secured from established discipline-oriented abstracting and indexing services. Currently an arrangement is in effect whereby the Bio-Science Information Service of Biological Abstracts supplies WRSIC with relevant references from the several subject areas of interest to our users. In addition to Biological Abstracts, references are acquired from Bioresearch Index which are without abstracts and therefore also appear abstractless in SWRA. Similar arrangements with other producers of abstracts are contemplated as planned augmentation of the information base.

The input from these Centers, and from the 51 Water Resources Research Institutes administered under the Water Resources Research Act of 1964, as well as input from the grantees and contractors of the Office of Water Research and Technology and other Federal water resource agencies with which the Center has agreements becomes the information base from which this journal is, and other information services will be, derived; these services include bibliographies, specialized indexes, literature searches, and state-of-the-art reviews.

Comments and suggestions concerning the contents and arrangements of this bulletin are welcome.

Water Resources Scientific Information Center
Office of Water Research and Technology
U.S. Department of the Interior
Washington, DC 20240

CONTENTS

FOREWORD iii

SUBJECT FIELDS AND GROUPS

Please use the edge index on the back cover to locate Subject Fields and Indexes.

01 NATURE OF WATER
Includes the following Groups: Properties; Aqueous Solutions and Suspensions

02 WATER CYCLE
Includes the following Groups: General; Precipitation; Snow, Ice, and Frost; Evaporation and Transpiration; Streamflow and Runoff; Groundwater; Water in Soils; Lakes; Water in Plants; Erosion and Sedimentation; Chemical Processes; Estuaries.

03 WATER SUPPLY AUGMENTATION AND CONSERVATION
Includes the following Groups: Saline Water Conversion; Water Yield Improvement; Use of Water of Impaired Quality; Conservation in Domestic and Municipal Use; Conservation in Industry; Conservation in Agriculture.

04 WATER QUANTITY MANAGEMENT AND CONTROL
Includes the following Groups: Control of Water on the Surface; Groundwater Management; Effects on Water of Man's Nonwater Activities; Watershed Protection.

05 WATER QUALITY MANAGEMENT AND PROTECTION
Includes the following Groups: Identification of Pollutants; Sources of Pollution; Effects of Pollution; Waste Treatment Processes; Ultimate Disposal of Wastes; Water Treatment and Quality Alteration; Water Quality Control.

06 WATER RESOURCES PLANNING
Includes the following Groups: Techniques of Planning; Evaluation Process; Cost Allocation, Cost Sharing, Pricing/Repayment; Water Demand; Water Law and Institutions; Nonstructural Alternatives; Ecologic Impact of Water Development.

07 RESOURCES DATA
Includes the following Groups: Network Design; Data Acquisition; Evaluation, Processing and Publication.

08 ENGINEERING WORKS
Includes the following Groups: Structures; Hydraulics; Hydraulic Machinery; Soil Mechanics; Rock Mechanics and Geology; Concrete; Materials; Rapid Excavation; Fisheries Engineering.

09 MANPOWER, GRANTS, AND FACILITIES
Includes the following Groups: Education—Extramural; Education—In-House; Research Facilities; Grants, Contracts, and Research Act Allotments.

10 SCIENTIFIC AND TECHNICAL INFORMATION
Includes the following Groups: Acquisition and Processing; Reference and Retrieval; Secondary Publication and Distribution; Specialized Information Center Services; Translations; Preparation of Reviews.

SUBJECT INDEX

AUTHOR INDEX

ORGANIZATIONAL INDEX

ACCESSION NUMBER INDEX

ABSTRACT SOURCES

SELECTED WATER RESOURCES ABSTRACTS

2. WATER CYCLE

2A. General

DEVELOPMENT OF AN EXTENSION OF ILLUDAS MODEL FOR CONTINUOUS SIMULATION OF URBAN RUNOFF QUANTITY AND DISCRETE SIMULATION OF RUNOFF QUALITY.
Purdue Univ., Lafayette, IN. Water Resources Research Center.
J. Han, and J. W. Delleur.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 483, Price codes: A07 in paper copy, A01 in microfiche. Technical Report No. 109, July 1979. 136 p, 20 fig, 25 tab, 31 ref, 3 append. OWRT C-6106 (no. 5213) (10).

Descriptors: *Urban runoff, *Rainfall-runoff relationships, *Simulation models, Storm runoff, Urban drainage, Soil moisture, Evaporation, Infiltration, Hydrograph, ILLUDAS.

Two short-time-interval simulation models were developed: the first is a continuous simulation of storm water runoff quantity, and the second is a single event runoff quality model. Both models are extensions of the Illinois Urban Drainage Area Simulator, ILLUDAS, and were verified on the Upper Ross-Ade Watershed in West Lafayette, Indiana. A time increment equal to the average inlet time of 5 minutes was the largest one giving acceptable hydrograph results for the watershed under study. The ILLUDAS model was extended to allow for a continuous simulation of the urban runoff. This was done by adding the subroutine DRYAMC which calculates the total rainfall during the five days preceding the storm to determine the antecedent moisture condition at the beginning of each storm. Further, the single event rainfall-runoff model ILLUDAS was coupled with a modified version of the runoff quality model STORM. In this fashion an integrated runoff quantity and quality model DRAINQUAL is obtained with the capability of simulating a pollutograph at 5 minute time intervals. Comparison with field measurements shows that the model predicts the BOD and suspended solids pollutographs fairly well.
W79-09832

A MATHEMATICAL MODEL OF STRATIFIED, BIDIRECTIONAL FLOW IN SHORT CULVERTS,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
D. G. Martin.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 494, Price codes: A05 in paper copy, A01 in microfiche. MS. Thesis, 1979. 75 p, 25 fig, 1 tab. OWRT-B-139-UTAH (5), 14-34-0001-7191.

Descriptors: *Computer models, Density stratification, Percolation, Finite element method, Continuity equation, Convection-diffusion, Culverts, *Stratified flow.

A two-dimensional computer model, simulating bidirectional, density-stratified gravity flow in the vertical plane is developed. The finite element method is applied to the governing equations, i.e., the equations of motion, continuity and convection-diffusion, to obtain a well-posed boundary value problem. The convection-diffusion equation is written in terms of the density difference between the unknown fluid density and the density of pure water. The dependent variables used in the system of equations are the horizontal and vertical components of velocity, the pressure and the density difference. The basic finite element shape is triangular. Both linear and isoparametric elements with six nodes (three nodes at the vertices and three on the mid-sides) are employed. Quadratic interpolation of the velocity variables is coupled with linear interpolation of both pressure and density. Assumptions consistent with the application to gravity flow in culverts are identified. The Galerkin method of weighted residuals is used to form suitable finite element equations. The nonlinear system of equations is solved using the Newton-Raphson iterative technique. Bidirectional flow is known to exist in the culverts located in the railroad causeway of the Great Salt Lake. The discharges, densities, temperatures, interface location, and head differences across the causeway were measured on a monthly basis, from October 1968 to September 1972, by the U.S. Geological Survey. This data was used to verify the mathematical model.
W79-09835

WATER QUALITY CHARACTERISTICS OF THE HORSE CREEK WATERSHEDS IN NORTH CENTRAL IDAHO,
Idaho Univ., Moscow.
J. G. King.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 487, Price codes: A07 in paper copy, A01 in microfiche. University of Idaho. Research Technical Completion Report, May 1979. 129 p, 33 fig, 46 tab, 67 ref, 8 append. OWRT A-051-IDA (1).

Descriptors: *Watersheds(Basins), *Sediment yield, *Geomorphology, *Sedimentology, Forest watersheds, Watershed management, Water quality, Water chemistry, Runoff, Snowmelt, Idaho, Bed load, Sediment load, Discharge(Water).

Ten undisturbed forested watersheds were analyzed to provide a means of watershed classification. The water quality processes of the watersheds were described and quantified, and the influences of geomorphology, climate, and channel stability on these processes were determined. The two most useful geomorphic descriptions in evaluating sedimentation differences were total basin area and relief ratio. Bedload transport rates and suspended sediment concentrations were monitored for three water years. Total annual sediment yields show a great deal of variability largely due to differences in water yields influenced by snowmelt volumes and rates. Approximately 95% of annual sediment production occurs during the snow melt season. Organic content and particle size distribution were determined for the transported bedload sediment and total sediment deposited in debris basins at the mouth of each watershed. Approximately 11% of the total deposited sediment was organic matter. Approximately 77% of the sediment transported in suspension was flushed through the debris basins resulting in low trap efficiency. The concentrations of sulfate, calcium, magnesium, potassium, and sodium, pH, specific conductivity, and alkalinity were low and were inversely related to stream discharge. Water quality and sedimentation are related to geomorphology and the use of geomorphologic parameters will provide better areal extrapolation of research results. (Seigler-IPA)
W79-09838

THE PREDICTION OF MEAN MONTHLY SOIL TEMPERATURE FROM MEAN MONTHLY AIR TEMPERATURE,
Denver Univ., CO. Dept. of Geography.
T. J. Toy, A. J. Kuhaida, and B. E. Munson.
Soil Science, Vol. 126, No. 3, p 181-189, September, 1978. 4 fig, 3 tab, 13 ref.

Descriptors: *Soil temperature, Air temperature, Climatic data, *Estimating equations, Model studies.

Though soil temperature is important to a variety of earth science subdisciplines, data are collected at few locations. This report presented simple, linear models for estimating mean annual, seasonal, and monthly soil temperatures with reasonable accuracy, using only air temperature data. A general equation based on all months and all sample stations taken together, seasonal equations, and equations for individual stations were provided. These models can be used to estimate soil temperature from air temperature data collected by the National Weather Service at stations throughout the United States. (Skogerboe-Colorado State)
W79-09906

PROCESS AND SYSTEM FOR RECOVERING WATER FROM THE ATMOSPHERE,
Mittex A.G., Vaduz (Liechtenstein).
W. Groth, and P. Hussmann.
U.S. Patent No. 4,146,372, 15 p, 4 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1384, March 27, 1979.

Descriptors: *Patents, Meteoric water, Water harvesting, Atmosphere, Moisture availability, Temperature, Adsorption, Condensation, Silica, Gels, Equipment.

Water is recovered from air by a process utilizing the differences in the day-time and night temperatures of such air. The process is especially useful in subtropical desert areas. It consists in alternately removing the moisture from the cool night air by adsorption on suitable adsorbing agents and especially on silica gel and by utilizing the hot day-time air and, if desired and available, the radiation energy of the sun for desorption of the water stored in the adsorbing agent and for condensing the desorbed water by means of the cold stored during the night. An especially suitable silica gel is used for adsorption of the water contained in the air. The energy required for operating the plant is produced by passing the recovered water through energy producing installations such as turbines before it is used as drinking water or for irrigation. The process is very economical and, in contrast to seawater desalination processes, does not require additional thermal energy. (Sinha-OEIS)
W79-09940

EXPERIMENTAL CONTROL OF BEACH FACE DYNAMICS BY WATERTABLE PUMPING,
Australian National Univ., Canberra (Australia). Dept. of Geography.
For primary bibliographic entry see Field 2L.
W79-09971

2B. Precipitation

A CLOUD-SEEDING EXPERIMENT IN TASMANIA,
Commonwealth Scientific and Industrial Research Organization, Sydney (Australia). Div. of Cloud Physics.
E. J. Smith, L. G. Veitch, D. E. Shaw, and A. J. Miller.
Journal of Applied Meteorology, Vol. 18, No. 6, p 804-815, June 1979. 3 fig, 9 tab, 12 ref, 1 append.

Descriptors: *Cloud seeding, *Weather modification, *Rainfall, *Australia, On-site investigations, Aircraft, Silver iodide, Statistics, Statistical methods, Regression analysis, Analytical techniques, Meteorology, *Tasmania.

A cloud-seeding experiment was conducted in Tasmania using a target area and three control areas. Seeding was on a random basis using silver-iodide smoke released from an aircraft. Evidence was presented that seeding increased rainfall in the eastern half of the target area during autumn. (Sims-ISWS)
W79-09963

SPATIAL CORRELATIONS OF MONTHLY RAINFALL: APPLICATIONS IN CLIMATOLOGY AND WEATHER MODIFICATION EXPERIMENTS,
Oak Ridge National Lab., TN.
A. A. N. Patrinos, N. C. J. Chen, and R. L. Miller.
Journal of Applied Meteorology, Vol. 18, No. 6, p 719-732, June 1979. 13 fig, 5 tab, 31 ref. DOE W-7405-eng-26.

Descriptors: *Rainfall, *Spatial distribution, *Correlation analysis, *Georgia, Powerplants, Effects, Weather modification, Distribution patterns, Winds, Rain, Precipitation(Atmospheric), Variability, Topography, Cooling water, Heated water, Climatology, Meteorology.

Spatial correlations based on monthly rainfall totals from northwest Georgia for the period 1949-

77 were studied. This work, a part of the Meteorological Effects of Thermal Energy Releases (METER) Program, determined natural variability rainfall trends and assisted the field studies of potential precipitation effects of the Bowen Electric Generating Plant near Cartersville, Georgia. The spatial correlations, based on the overall record as well as the stratified data in terms of 'wet' and 'dry' seasons, were investigated with regard to distance between stations, wind direction, and topography. The results indicated a strong dependence of the spatial correlation patterns on the prevailing storm tracks in the area. A method was developed using the spatial correlation as an indicator of effects on weather modification experiments. This method was based on the generation of empirical distribution functions by randomization for various sample sizes. The application of this technique to the Plant Bowen study in a control target statistical design revealed preliminary positive evidence of rainfall modification in the target area. (Sims-ISWS)
W79-09964

CHANGES IN CLOUD BASE PRECIPITATION PARTICLE SIZE-DISTRIBUTIONS AS A RESPONSE VARIABLE TO SEEDING,
Meteorology Research, Inc., Altadena, CA.
D. M. Takeuchi.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-299 549, Price codes: A03 in paper copy, A01 in microfiche. Technical Report No. MRI 79 TR-1683, June 26, 1979. 28 p, 9 fig, 5 tab, 3 ref. 14-06-D-7699.

Descriptors: *Cloud seeding, *Weather modification, *Precipitation(Atmospheric), *Cloud physics, Snow, Hail, Particle size, Rainfall, Montana, Convection, Chemistry of precipitation, Silver iodide, Carbon dioxide.

A statistical analysis was performed on measurements of changes in precipitation particle size distributions of subcloud and cloud base regions of seeded and non-seeded summertime convective clouds. Measurements were taken with PMS wide arm 1-D precipitation probe by the MRI Navajo cloud physics aircraft during the summers of 1976 and 1977 near Miles City, Montana. Horizontal penetrations were made through the center of the precipitation shaft. Sample procedures were identical for both seeded (Ag I and CO2) and nonseeded clouds. For given intensities, the natural size spectra differs significantly among natural clouds producing precipitation of: (1) snow, (2) rain and/or graupel, and (3) hail with graupel and/or rain. Results show that: (1) in snow producing clouds, seeding increases the number concentrations of the larger particle; (2) in rain and/or graupel producing clouds, seeding produces significantly higher total number concentrations and results in lower number concentrations at the larger particle sizes; and (3) in hail producing clouds, seeding creates increased numbers of large particles, but the changes were not significant at the 5% level of significance. (Seigler-IPA)
W79-10025

MID-EOCENE CLIMATIC CHANGE, SOUTHWESTERN CALIFORNIA AND NORTHWESTERN BAJA CALIFORNIA,
San Diego State Univ., CA. Dept. of Geological Sciences.
G. L. Peterson, and P. L. Abbott.
Palaeogeography, Palaeoclimatology, Palaeoecology, Vol. 26, No. 1/2, p 73-87, February 1979. 3 fig, 1 tab, 43 ref.

Descriptors: *Paleoclimatology, *Paleolimnology, *Paleosols, *Geologic history, *Stratigraphy, History, Paleohydrology, Geologic time, Climatic data, Climatology, Climatic change, Sedimentary petrology, Sedimentology, Sedimentary rocks, Dating, California, Baja California, Cenozoic era, Tertiary period.

A comparison of some sedimentary characteristics in southwestern California and northwestern Baja California reveals a profound climatic change since Paleocene time. Data presented here demonstrate Eocene climatic change and describe distribution and character of evidence upon which this thesis is based. While the severely weathered, differentially preserved and buried Eocene rock units in the California area of this region are believed to have developed under humid tropical conditions prevailing during Paleocene/mid-Eocene period, a variety of Middle and Upper Eocene sedimentary formations overlie this ancient soil profile that are strongly indicative of a semiarid Paleoclimate. Rainfall during this period is believed to have been less than 63 cm/yr, seasonal, and characterized by flash floods. Fluvial conglomerates indicate that chemical weathering and rainfall were minimal, thus the river system probably was ephemeral. A tabulated comparison of the various time periods indicates that the Late Eocene was much closer to the present climate in the area than that during any other period, and suggests that a climatic change of the type and magnitude described should be reflected on a regional if not global scale. (Tickes-Arizona)
W79-10076

RAINFALL IN SOUTHERN CALIFORNIA,
San Diego State Univ., CA. Dept. of Geological Sciences.
M. Sheely, and C. E. Dorman.
Weatherwise, Vol. 32, No. 3, p 119-122, June, 1979. 3 fig, 2 tab, 4 ref.

Descriptors: *Atmospheric precipitation, *Rainfall disposition, *Depth-area-duration analysis, *Atmospheric pressure, Meteorological data, Air environment, Physical properties, Correlation analysis, Forecasting, California.

The relationship between variations in the South Pacific pressure gradient and anomalous rainfall in the Southern California highland is examined here as a tool for forecasting if the next season in southern California will be anomalously wet or dry. To explore this relation the Cuyamala Reservoir in California was selected for comparison with 21 other stations in the southwestern U.S. and rainfall pattern similarities were determined by correlating monthly rainfall totals. The resultant contour map of correlation coefficients indicates that correlations diminish slowly toward the north and parallel the high elevations but dramatically decrease in an east-west direction with the terrain. Of the six significantly wet years shown here, 5 were associated with a pressure gradient of less than 5.7 mb in September of that rainyear and 5.7 mb in September is considered to be a good indicator of a wet year in the southern California mountains. This inverse relationship is of particular value in estimating water resources, fire hazards, and flooding potential in the southern California mountains. (Tickes-Arizona)
W79-10078

2C. Snow, Ice, and Frost

THE FORMATION OF MEDIAL MORAINES ON ALPINE GLACIERS,
Southampton Univ. (England). Dept. of Geography.
R. J. Small, M. J. Clark, and T. J. P. Cawse.
Journal of Glaciology, Vol. 22, No. 86, p 43-52, 1979. 4 fig, 3 tab, 14 ref.

Descriptors: *Glaciers, *Glacial drift, *Alpine, Till, Ablation, Growth rates, Melting, On-site investigations, Ice, Rocks, Glaciology, *Switzerland, Medial moraines, Englacial till, Debris.

Field investigation of 6 medial moraines on glaciers near Arolla, Valais, Switzerland, has revealed that all are nourished by englacial till. This is probably derived from supraglacial point-sources on the accumulation zones of the glaciers, and is released in increasing quantities on the ablation zones, where it emerges diffusely or by way of clearly defined transverse or longitudinal debris bands. Possible mechanisms of formation of these debris bands were reviewed, and it was proposed that the transverse bands originated as crevasse fillings on the accumulation zones. Morphologically, all 6 moraines display waxing sections (of increasing height and breadth), related to development of a protective till cover and resultant differential ablation of the glacier surface. Two only display waning sections (of decreasing height), resulting from lateral sliding of till and 'inverted' differential ablation resulting from extreme attenuation of till cover. Four 'moraine-types' (related to nature of debris supply and detailed morphology) were identified in the Arolla area. It is believed that these may form the basis for a classification of medial moraines. (Sims-ISWS)
W79-09973

PATTERN OF ICE SURFACE LOWERING FOR RENNICK GLACIER, NORTHERN VICTORIA LAND, ANTARCTICA,
New Hampshire Univ., Durham. Dept. of Earth Sciences.
P. A. Mayewski, J. W. Attig, Jr., and D. J. Drewry.
Journal of Glaciology, Vol. 22, No. 86, p 53-65, 1979. 7 fig, 2 tab, 11 ref. NSF OPP74-15210.

Descriptors: *Glaciers, *Antarctic, *Glaciation, Ice, Movement, Surfaces, Glacial drift, On-site investigations, Remote sensing, Fluctuations, Sea level, Glaciology, *Rennick Glacier(Antarctic), *Victoria Land(Antarctic).

Rennick Glacier is one of the major ice drainages in northern Victoria Land. Unlike glaciers farther south along the Transantarctic Mountains, Rennick Glacier does not drain into the Ross Ice Shelf but flows directly into a seasonally ice-covered ocean. Therefore, current fluctuations of this glacier are unhampered by the dampening effects of the Ross Ice Shelf. The primary controls on the activity of this glacier and others in this region are mass balance and sea-level. Two major glacial events were recorded in the upper Rennick Glacier region. The location of erratics and glacially scoured features suggest that during the oldest or Evans glaciation, ice covered all but the highest peaks in the region. Following this glaciation, a readvance produced the Rennick glaciation. Drift produced during this glaciation has a surface cover of unweathered class and is commonly found in the form of recessional moraines with associated ice-marginal lakes. Rennick Glacier is currently in a recessional phase of the Rennick glaciation. The phase is characterized by physical re-adjustments of local ice masses including progressive inland migration of the Rennick Glacier grounding line. To date, the grounding line has migrated up to the mid-point of the glacier. This trend may be expected to continue. (Sims-ISWS)
W79-09974

GRAIN COARSENING OF WATER-SATURATED SNOW,
Washington Univ., Seattle. Geophysics Programs.
C. F. Raymond, and K. Tusima.
Journal of Glaciology, Vol. 22, No. 86, p 83-105, 1979. 8 fig, 5 tab, 17 ref.

Descriptors: *Snow, *Particle size, *Aging(Physical), Laboratory tests, Freezing, Melting, Heat flow, Heat transfer, Growth rates, Ice, Physical properties, Grain coarsening, Water-saturated snow.

Experimental measurements were made of changes in grain-size distribution with time in snow saturated with solutions of various impurity contents. Qualitatively, the changes in grain-size distribution occur by shrinkage and eventual disappearance of the relatively small particles and growth of the relatively large particles by a solid mass-exchange process which conserves the total solid mass. The distribution of relative lasting only several to several tens of hours after the time of initial saturation. Mean grain volume increased at a constant rate, which for solutions of impurity concentration less than about 0.01 mol/l was 0.005 to 0.006 cu mm/h. Once the steady relative-size distribution was established, the rate of volume change of typical grains varied linearly with grain volume from the characteristic negative rate for the smallest particles through 0 for particles of mean volume to positive values for particles of larger volume. (Sims-ISWS)
W79-09975

2D. Evaporation and Transpiration

THE ROLE OF EVAPOTRANSPIRATION MODELS IN IRRIGATION SCHEDULING,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
M. E. Jensen, and J. L. Wright.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 21SW, No. 1, p 82-87, February 20, 1978. 4 fig, 2 tab, 25 ref.

Descriptors: Scheduling, Irrigation, *Evapotranspiration, *Model studies, Soil moisture, Statistical methods, *Irrigation scheduling.

Most evapotranspiration (ET) models are based on physical principles controlling evaporation and the conservation of mass and energy, and use daily climatic data. ET models coupled with irrigation models are valuable tools because they enable trained and experienced irrigation specialists to provide irrigation scheduling services at a reasonable cost. Estimated standard deviations of mean daily ET for 1- to 30-day periods at Akron, Colorado; Davis, California; Kimberly, Idaho; and Lompoc, California varied from 0.9 to 1.3 mm/day and it decreased to 0.4 to 0.7 mm/day for 15- to 30-day periods. Standard errors of ET estimates with a combination equation based on 243 days of data from Kimberly, Idaho were normally distributed and for daily values the standard error was 1.0 mm/day. This parameter decreased inversely with the square root of the number of days for up to 30 days and was similar to those reported for other areas using models that operate on daily climatic data. A summary of factors affecting confidence levels in irrigation scheduling was presented along with the expected standard deviations. Generally, the error in measuring soil moisture was generally smaller than estimated ET and irrigation application errors. (Skogerboe-Colorado State)
W79-09914

2E. Streamflow and Runoff

PROBABILITY DISTRIBUTIONS OF BEST FIT TO SOUTH AFRICAN FLOOD DATA,
Department of Water Affairs, Pretoria (South Africa). Hydrology, Div.
P. T. Adamson.
Water S.A., Vol. 5, No. 21, p 70-76, April 1979. 3 fig, 7 tab, 24 ref.

Descriptors: *Flood forecasting, *Flood profiles, *Design flood, *Mathematical models, Statistical methods, Analytical techniques, Probability, Flood data, Distribution, Numerical analysis, South Africa.

Five statistical models for flood analysis were tested to determine their relative performance as applied to floods in South Africa. The models are: a two parameter log-Normal distribution (LN2), a three parameter log-Normal distribution (LN3), a log-Pearson type 3 distribution (LP3), an extreme value type 1 distribution (EV1), and an extreme value type 2 distribution (EV2). All models were fitted by the method of moments. Fifty South African annual flood peak data sets were fitted to the models. The data have a minimum length of record of 25 years with a mean length of record of 46 years. No tests of homogeneity were applied largely because the correction of the effects of dams, urbanization, improved land drainage, channel improvements, vegetation changes, and improvements to hydrometric structures and ratings would have been too large. Results show: (1) EV1 should be discouraged as a means of statistical annual flood peak analysis in South Africa; (2) the log-Normal 2-parameter and log-Pearson type 3 models, on the evidence of fit alone, provide the 'best' models; (3) the log-Pearson type 3 model gives much higher estimates for return periods greater than 100 years than the log-Normal 2-parameter model; (4) on the average, the log-Normal 3-parameter and the extreme value type 2 models give similar results; and (5) two models are limited by a fixed skew, but the log-Normal 2-parameter model can overcome this when fitted by moments. (Seigler-IPA)
W79-09842

COMPARATIVE EVALUATION OF STATISTICAL METHODS FOR WATER SUPPLY FORECASTING,
Maryland Univ., College Park. Dept. of Civil Engineering.
R. H. McCuen, W. J. Rawls, and B. L. Whaley.
Water Resources Bulletin, Vol. 15, No. 4, p 935-947, August 1979. 1 fig, 3 tab, 6 ref.

Descriptors: *Evaluation, *Statistical methods, *Water supply, *Forecasting, *Hydrologic data, *Mathematical models, Water yield, Seasonal, Comparison, Regression analysis, Streamflow, Volume, Equations, Systems analysis, Upper Sevier River basin(Utah).

While the correlation coefficient and standard error of estimate are frequently used when comparing models of seasonal water yield, the following criteria may be more important in selecting one model from among several alternatives: Rationality of the regression coefficients, the distribution of the residual errors, and the correctness of indicators of the relative importance of the predictor variables. These criteria were used to compare seasonal water yield models that were calibrated using multiple regression, stepwise regression, principal components regression, polynomial regression using a principal components rotation, and constrained pattern search. Hydrologic data from the Upper Sevier River basin in southern Utah were used to illustrate the comparative analysis process. The prediction equations used the April-July streamflow volume as the criterion variable. (Bell-Graf--Cornell)
W79-09870

METHODOLOGY OF STUDIES ON CHEMICAL PROCESSES IN WATER RUNOFF FROM ROCK AND SHALLOW SOIL COVER USING RADIOACTIVE TRACERS,
Institutt for Atomenergi, Kjeller (Norway).
For primary bibliographic entry see Field 2K.
W79-09980

INTERACTION BETWEEN SIMULATED RAIN AND BARREN ROCK SURFACE,
Norske Skogforsoksvesen, Oslo.
For primary bibliographic entry see Field 2K.
W79-09981

FLOOD PLAIN INFORMATION: POJOAQUE RIVER AND TRIBUTARIES, SANTA FE COUNTY, NEW MEXICO,
Army Engineer District, Albuquerque, NM.
Prepared for the County of Santa Fe, NM, August 1977. 32 p, 1 fig, 50 plates, 7 tab.

Descriptors: *New Mexico, *Flooding, *Flood profiles, *Flood data, *Flood stages, *Flood plains, *Santa Fe County(NM), *Pojoaque River(NM), Floods, Indirect flood measurement, Historic floods, Flood frequency, Peak discharge, Flood peak, Flood waves, Flow duration, Flow characteristics, Rivers, Flood protection, Warning systems, Levee, Pojoaque Creek(NM), Rio Tesuque(NM), San Ildefonso(NM), 100-year flood, 500-year flood.

The study area includes the flood plains of the Pojoaque River and its tributaries located in the northwestern portion of Santa Fe County. The flood plain is primarily rural with large amounts of open space. Flood data were obtained from aerial photographs, topographic maps, stream gaging stations, and field surveys. The Corps of Engineers repaired and rebuilt a levee system but this system will not contain an Intermediate Regional Flood and was assumed to be nonexistent for purposes of this study. Major flood-producing storms have been experienced most often during the July, August, and September period. The worst recorded flood in the lower reach of the Pojoaque River below San Ildefonso occurred in 1955, discharging 15,000 cubic feet per second (cfs). The peak discharge of the 100-year flood on the Pojoaque River would be 13,500 cfs, and for its tributaries, Pojoaque Creek and Rio Tesuque, 12,700 cfs and 10,640 cfs, respectively. The peak discharge of the 500-year flood on the Pojoaque River would be 38,600 cfs and for its tributaries, Pojoaque Creek and Rio Tesuque, 36,400 cfs and 30,400 cfs, respectively. This report furnishes a suitable basis for adoption of land use plans to guide flood plain development. (Coan-NC)
W79-10012

FLOOD PLAIN INFORMATION: MIMBRES RIVER AND FLORIDA GAP DRAW, DEMING, LUNA COUNTY, NM.
Army Engineer District, Albuquerque, NM.
Prepared for the Luna County Board of County Commissioners, NM, September 1978. 25 p, 3 fig, 22 plates, 5 tab.

Descriptors: *Flooding, *Flood profiles, *Peak discharge, *Flood plains, *Luna County(NM), *Florida Gap Draw(NM), *Mimbres River(NM), *New Mexico, Floods, Indirect flood measurement, Storms, Cloudbursts, Flood stages, Flood peak, Flow duration, Flow characteristics, Rivers, Flood protection, Warning systems, Deming(NM), 100-year flood, 500-year flood.

The study area is the flood plain of the Mimbres River near Deming in Luna County, New Mexico. Existing developments on the flood plains in the study area are primarily farm homes and associated farm buildings. Flood data were obtained from aerial photographs, field surveys, and historical records. There are no structures in the study area with significant water regulating facilities. Most of the rainfall in the area occurs during the summer months and consists mainly of thunderstorm or cloudburst type. Historical records were searched for past floods in Luna County, but nothing significant was found. The 100-year flood for the Mimbres River is expected to have a peak discharge of 15,700 cubic feet per second (cfs), reach a height of rise of six feet above bankfull stage, and last about 13.4 hours. The 500-year flood on the Mimbres River would have a discharge of 77,270 cfs, reach a height of 5.7 feet above bankfull stage, and last for 23.7 hours. This report will aid in the development of flood damage reduction measures and provide a basis for land use planning in flood plains. (Coan-NC)
W79-10013

FLOOD HAZARD ANALYSES, WORTHLEY BROOK, TOWN OF POLAND, MAINE, ANDROSCOGGIN COUNTY,
Soil Conservation Service, Orono, ME.
September 1977. 6 p, 5 fig, 5 plates, 2 tab.

Descriptors: *Maine, *Floods, *Historic floods, *Flood data, *Flood stages, *Peak discharge, *Stage-discharge relations, *Worthley Brook(ME), *Poland(ME), *Androscoggin County(ME), Regional flood, Indirect flood measurement, Flood profiles, Rivers, Flood plains, Flood protection, Flood plain insurance, 100-year flood, 500-year flood.

This report identifies and delineates the flood hazard areas along three miles of Worthley Brook from the Town of Poland in southern Maine. Drainage area of the study reach is about 8.5 miles to its confluence with the Little Androscoggin River. Flood plain width varies from 300 feet up to a maximum of 1000 feet. Development in the flood plain includes part of the Town of Poland, and recreation areas. Though no urban centers exist adjacent to the flood plain, development pressure to build residential dwellings in the area does exist. There are no stream gages on Worthley Brook. Flooding is caused primarily by spring snowmelt and by brief but intense summer storms. Major flooding occurred in March 1936 and March 1953. The 1936 flood is estimated to be in the vicinity of the 100-year flood. The 100-year and 500-year floods are projected to have peak discharges of up to 840 cubic feet per second (cfs) and 1,340 cfs, respectively. No existing or planned structural measures are known that would affect flooding. This report is intended to provide a technical basis for flood plain management; suggestions include institution of land use planning, flood plain acquisi-

tion and regulations, and the use of conservation easements. (Arnold-NC)
W79-10014

2F. Groundwater

EXPERIMENTAL CONTROL OF BEACH FACE DYNAMICS BY WATERTABLE PUMPING,
Australian National Univ., Canberra (Australia). Dept. of Geography.
For primary bibliographic entry see Field 2L.
W79-09971

NITROGEN-ISOTOPE RATIO STUDIES OF SOILS AND GROUNDWATER NITRATE FROM ALLUVIAL FAN AQUIFERS IN TEXAS,
Texas Univ. at Austin. Bureau of Economic Geology.
For primary bibliographic entry see Field 5B.
W79-09983

AN ANALYTICAL SOLUTION FOR THE TRANSIENT DITCH DRAINAGE PROBLEM,
Center for Water Resources Development and Management, Trivandrum (India).
For primary bibliographic entry see Field 2G.
W79-09984

LAGOON RECHARGE OF THE FOLKESTONE BEDS AT HARDHAM, SUSSEX--1972-75,
Southern Water Authority, Eastleigh (England). Directorate of Resource Planning.
For primary bibliographic entry see Field 4B.
W79-09988

CANAL SEEPAGE WITH BOUNDARY AT FINITE DEPTH,
Rookee Univ. (India). Water Resources Development Training.
For primary bibliographic entry see Field 2G.
W79-09990

2G. Water In Soils

INTAKE CHARACTERISTICS OF IRRIGATION FURROWS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
D. D. Fangmeier, and M. K. Ramsey.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 21SW, No. 4, p 696-700, 705, August 20, 1978. 3 fig, 3 tab, 5 ref.

Descriptors: Infiltration, Intakes, *Furrow irrigation, *Infiltration rates, Estimating equations.

Seven irrigations were conducted on precision field furrows. Water volume balances were used to calculate infiltration and intake functions. The Philip equation provided a slightly better estimate of infiltration than the Kostiakov equation, but the constants in the Philip equation were more difficult to obtain. The intake rate appeared to be linearly related to the wetted perimeter for the irrigation conducted. (Skogerboe-Colorado State)
W79-09909

NITROGEN AND CHLORIDE LEACHING IN A SANDY FIELD PLOT,
Department of Agriculture, Ottawa (Ontario). Soil Research Inst.
D. R. Cameron, C. G. Kowalenko, and K. C. Ivarson.
Soil Science, Vol. 126, No. 3, p 174-180, September, 1978. 3 fig, 2 tab, 15 ref.

Descriptors: *Nitrogen, *Chloride, *Leaching, Leachate, Environmental sanitation, Denitrification, Nitrates.

In field experiments conducted on a well-drained, sandy soil, 59 and 99 percent of the added chloride was lost by leaching from the 0-75-cm layer by the end of October in 1975 and 1976, respectively. Chloride losses were proportional to total precipitation. The average spring-to-fall rates of N losses for 1975 and 1976 were 0.65 and 1.45 kg N/ha/day, and were directly proportional to N fertilization rates of 120 and 255 kg/ha, respectively. NO3-N and Cl tended to show similar distribution patterns in the profile, and ratios of Cl to NO3-N indicated predominant leaching rather than denitrification losses. N and Cl losses appeared to be associated with irregular, diffuse bulges, rather than with distinct peaks of solute moving steadily downward. (Skogerboe-Colorado State)
W79-09911

SOIL WATER CONTENT AND TEMPERATURE AS FACTORS IN THE VOLATILE LOSS OF APPLIED MERCURY (II) FROM SOILS,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 2K.
W79-09916

TIME OF SPREAD RELATIONSHIP IN IRRIGATION CHECK BASINS,
Guelph Univ. (Ontario).
T. C. Sharma.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 21SW, No. 3, p 505-509, June 20, 1978. 3 fig, 4 tab, 5 ref.

Descriptors: Basins, *Irrigation, Dimensional analysis, Infiltration, Estimating equations, *Water spreading.

Time of spread of water in a check basin is of vital importance for designing efficient check basin irrigation system. The analytical solutions for determination of time of spread tend to be quite complex and impractical due to the unsteady spatially varied nature of flow on nearly zero slopes of the land. In this study, the technique of dimensional analysis was used to derive time of spread relationships in check basins. (Skogerboe-Colorado State)
W79-09917

INFILTRATION OF LIQUID DAIRY MANURE INTO SOIL,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
For primary bibliographic entry see Field 5E.
W79-09965

WATER REQUIREMENTS AND WATER TABLE VARIATIONS FOR A CONTROLLED AND REVERSIBLE DRAINAGE SYSTEM,
Science and Education Administration, Florence, SC. Coastal Plains Soil and Water Conservation Research Center.
C. W. Doty, and J. E. Parsons.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 3, p 532-536 and 539, May-June 1979. 8 fig, 2 tab, 11 ref.

Descriptors: *Drainage, *Irrigation, *Water table, Variability, Fluctuations, Soil water, Storage, Water requirements, Crops, Crop production, Corn(Field), Tiles, Tile drains, Tile drainage, Pumping, Agriculture, Reversible drainage systems, Water mounds.

A water mound can be built by controlling the head above the tile outlet. The approximate shape of the mound above three tile spacings, the water requirements, head requirements, and the yield relations to tile depths and spacings were presented. (Sims-ISWS)
W79-09966

SUBSIDENCE RELATED TO LAND USE IN EVERGLADES AGRICULTURAL AREA,
Agricultural Research and Education Center, Belle Glade, FL.
For primary bibliographic entry see Field 4A.
W79-09968

ENGINEERING PROBLEMS ASSOCIATED WITH EXPANSIVE CLAYS FROM ROMANIA,
Institutul de Constructii din Bucuresti (Romania). Dept. of Soil Mechanics and Foundation Engineering.
M. E. Popescu.
Engineering Geology, Vol. 14, No. 1, p 43-53, June 1979. 6 fig, 2 tab, 16 ref.

Descriptors: *Expansive clays, *Soil physical properties, *Shrinkage, *Soil mechanics, Clays, Moisture content, Soil structure, Consolidation, Voids, Soil moisture, Anisotropy, Laboratory tests, Analysis, Foreign research, Soil tests, Foreign countries, *Romania.

Engineering problems associated with expansive clay formations, which have a large swelling and shrinking potential, exist in different regions of Romania. In the general framework of the study of the behavior of expansive clays, this paper described some particular aspects connected with the swelling and shrinkage processes and their engineering effects in Romania. The differences between swelling potential relationships, obtained by two different methods, were presented and discussed. Swelling pressure tests were accomplished using the available standard techniques, as well as a specially developed cell pressure equipment. Attention was drawn to the stages of the shrinkage process as related to soil structure. It was found that, in a general case, there are 3 distinct stages: initial, normal, and residual shrinkage. Laboratory investigations have shown that in soils with an anisotropic structure, the directional variation of shrinkage strains is elliptical in shape, with the maximum shrinkage normal to particle orientation. The engineering aspects of the results were discussed. The paper is thought to be a useful contribution to a better understanding of swelling and shrinking behavior, at least in some of its particular aspects, such as the laboratory measurement of absolute swelling pressure, shrinkage process stages, and the effect of anisotropy on shrinkage of expansive clays. (Humphreys-ISWS)
W79-09972

USE OF FLUORESCENT DYES TO MARK THE PATHWAYS OF SOLUTE MOVEMENT THROUGH SOILS UNDER LEACHING CONDITIONS: 1. LABORATORY EXPERIMENTS,
Reading Univ. (England). Dept. of Soil Science.
U. Omoti, and A. Wild.
Soil Science, Vol. 128, No. 1, p 28-33, July 1979. 3 fig, 3 tab, 16 ref.

Descriptors: *Solutes, *Soil water, *Soil water movement, Laboratory tests, Dyes, Fluorescent dye, Photography, Ultraviolet radiation, Chlorides, Adsorption, Soils, Soil science, Pyranine, Fluorescein.

A technique was described to identify the pathways of solute movement down columns of sieved soil aggregates using fluorescent dyes and recording their presence by ultraviolet photography. Pyranine was found to be the most useful dye for short-term laboratory experiments because of its high fluorescence and comparatively low adsorption coefficient. The uneven distribution of pyranine across the horizontal faces of successive soil sections, as shown by ultraviolet photography, indicated that the solute moved preferentially in some parts of the column. The technique was found to be of value in checking the uniform packing of columns of soil aggregates and to have potential use under field conditions. (Sims-ISWS)
W79-09976

COMPUTER SIMULATION MODEL FOR PREDICTING SOIL WATER CONTENT PROFILES,
Department of Agriculture, Swift Current (Saskatchewan). Research Station.
R. de Jong, and D. R. Cameron.
Soil Science, Vol. 128, No. 1, p 41-48, July 1979. 7 fig, 1 tab, 17 ref.

Descriptors: *Soil water, *Soil water movement, *Model studies, Mathematical models, Computer models, Hydraulic conductivity, Diffusivity, Evapotranspiration, Evaporation, Moisture content, Rainfall, Crops, Vegetation, Vegetation effects,

On-site investigations, Sampling, Soil-water-plant relationships, Soils, Soil science.

A simulation model describing water movement through field-cropped soils was developed. The soil water flow equation, which included a root extraction term, was approximated using a finite difference technique. Hydraulic conductivity (K) and diffusivity (D) functions were calculated by using the Millinton-Quirk technique. The chosen boundary conditions, rainfall, evapotranspiration, and a fluctuating water table approximated those existing in the field. Submodels to calculate interception, evaporation, and transpiration were included in the model. Model predictions were in good agreement with field data from a fairly uniform soil. On a soil containing discontinuous clay varves, the predictions were not satisfactory when the original calculated K and D functions were used. Predicted and measured water content profiles were in closer agreement when the K and D functions were modified within the limits of the measured moisture retention curve data. (Sims-ISWS)
W79-09977

SIMULATION OF INFILTRATION FROM A CONTINUOUS AND AN INTERMITTENT SUBSURFACE SOURCE,
Cook Coll., New Brunswick, NJ.
W. J. Busscher.
Soil Science, Vol. 128, No. 1, p 49-55, July 1979. 8 fig, 7 ref.

Descriptors: *Infiltration, *Subsurface flow, *Unsteady flow, *Model studies, Mathematical models, Computer models, Soil water, Soil water movement, Flow, Hydraulic conductivity, Soils, Subsurface waters, Intermittent water sources, Piezometric potential, Matric potential.

Infiltration from an intermittently flowing subsurface source of water was compared via numerical methods with a continuous source. Though the intermittent source was flowing for only 50% of the time on a 4-h cycle, its cumulative infiltration was 80% of that for the continuous source at 175 h after the initiation of flow. Furthermore, this latter percentage increased with time. This high value was caused by redistribution during no-flow conditions, which increased the matric potential gradient near the source causing a rapid influx of water when flow was reinitiated. (Sims-ISWS)
W79-09978

NITROGEN-ISOTOPE RATIO STUDIES OF SOILS AND GROUNDWATER NITRATE FROM ALLUVIAL FAN AQUIFERS IN TEXAS,
Texas Univ. at Austin. Bureau of Economic Geology.
For primary bibliographic entry see Field 5B.
W79-09983

AN ANALYTICAL SOLUTION FOR THE TRANSIENT DITCH DRAINAGE PROBLEM,
Center for Water Resources Development and Management, Trivandrum (India).
P. Basak.
Journal of Hydrology, Vol. 41, No. 3/4, p 377-382, May 1979. 3 fig, 4 ref.

Descriptors: *Drainage, *Ditches, *Water table, Equations, Recharge, Groundwater, Soil water, Hydraulics, Seasonal, Water balance, *Boussinesq equation, Transient water table.

The problem of the transient water table between two parallel ditches which are subject to a uniform recharge was analytically investigated. A closed-form solution of the governing nonlinear partial differential equation was obtained for the first time and was reported in this paper. The solution gives the transient water table profile at any nondimensional recharge rate P. The drainage spacing formula in the presence of recharge is consequently derived. In the absence of recharge, the drainage spacing expression reduces to the known exact solution owing to Boussinesq with a modified constant. (Lee-ISWS)
W79-09984

INFILTRATION AS INFLUENCED BY IRRIGATION WATER QUALITY,
Science and Education Administration, Riverside, CA. Salinity Lab.
For primary bibliographic entry see Field 5C.
W79-09989

CANAL SEEPAGE WITH BOUNDARY AT FINITE DEPTH,
Rookee Univ. (India). Water Resources Development Training.
H. D. Sharma, and A. S. Chawla.
Journal of the Hydraulics Division, American Society of Civil Engineers, Vol. 105, No. HY7, Proceedings Paper 14715, p 877-897, July 1979. 14 fig, 15 ref, 1 append.

Descriptors: *Seepage, *Canals, *Drainage, Hydraulics, Phreatic lines, Channels, Equations, Mapping, Discharge(Water), Groundwater, Soil water, *Conformal mapping, Phreatic surface.

Closed-form solution for the problem of seepage from channels in homogeneous and isotropic material extending up to finite depth with drainages at a finite distance from the canal and at finite depth has been obtained by the use of conformal mapping. Equations for seepage discharge and the shape of the phreatic line were given. The analysis indicated that the phreatic surface rises with decrease in the depth of impervious layer and increase in the width of the channel and the drainage distance. For larger values of T/n, the phreatic surface was seen to curve continuously and is S-shaped. With a decrease in the value of T/n, the curvature of the phreatic surface is reduced. It also was seen that the seepage discharge increases with an increase in the depth of the pervious stratum and approaches the value for the case of a canal with depth of pervious stratum extending to infinity. (Lee-ISWS)
W79-09990

FERTILIZER NITROGEN DISTRIBUTION UNDER IRRIGATION BETWEEN SOIL, PLANT, AND AQUIFER,
Minnesota Univ., St. Paul.
For primary bibliographic entry see Field 4B.
W79-10024

SALINITY PROFILES AND LEACHING FRACTIONS FOR SLOWLY PERMEABLE IRRIGATED FIELD SOILS,
Science and Education Administration, Brawley, CA. Imperial Valley Conservation Research Center.
W. E. Lonkerd, C. F. Ehlig, and T. J. Donovan.
Journal of the Soil Science Society of America, Vol. 43, No. 2, p 287-289, Mar.-Apr., 1979, 2 fig, 1 tab, 6 ref.

Descriptors: *Leaching, *Saline soils, *Permeability, *Crop response, *Irrigation efficiency, *Soil water movement, Soil management, Soil water, Crop production, Irrigation effects, Imperial Valley, California, Horticultural crops, Agronomic crops, Root zone.

Although it is necessary to periodically leach accumulated salts within the root zone of irrigated crops, there is only limited information available on the actual magnitude and variability of leaching fractions in commercial crop fields of low water intake soils. Accordingly, the purpose of the present study was to determine the soil salinity status and leaching fractions on four representative Imperial Valley soils planted to alfalfa, cotton, lettuce, sugarbeets, and wheat. Soils were sampled in 33 alfalfa (Medicago sativa L.), 13 cotton (Gossypium hirsutum L.), 19 lettuce (Lactuca sativa L.), 17 sugarbeet (Beta vulgaris L.), and 21 wheat (Triticum aestivum L.) fields in 30 cm increments to a 150 cm depth. Accumulated data were tabulated to show the range and median values of ECe, CLe, and LF below the plant root zones. Assuming a desirable leaching fraction of 15-20% for lettuce and 5-10% for alfalfa, cotton, sugarbeets, and wheat, results for nearly all soil-crop combinations indicated that leaching fractions ranged from insufficient or marginal in Imperial and Meloland soils planted to all crops, to excessive in Holtville and Indio soils planted to lettuce, sugarbeets, and wheat. It is hoped that this information will be used in the development of appropriate management practices to increase water use efficiency in irrigation while avoiding the consequences of excessive salinity on crop yield. (Tickes-Arizona)
W79-10075

2H. Lakes

DISTRIBUTION PATTERNS AND POPULATION DYNAMICS OF POLYPHEMUS PEDICULUS (L.) (CRUSTACEA, CLADOCERA) IN A SMALL NEW ENGLAND LAKE,
New Hampshire Univ., Durham.
M. T. Mattson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 486, Price codes: A09 in paper copy, A01 in microfiche. Doctor of Philosophy Dissertation, 1979. 173 p, 26 fig, 9 tab, 107 ref. OWRT A-041-NH (1), 14-31-0001-5029.

Descriptors: *Aquatic populations, *Distribution patterns, *Crustaceans, Ponds, Migration, On-site investigations, Diel migration, Barrington(NH), *Polyphemus pediculus.

A stratified random sampling design was evaluated in its ability to quantify spatial and seasonal changes in abundance of the predatory cladoceran, Polyphemus pediculus (L.). A whole-lake stratified design with sample units consisting of eighty-four 20-meter Clarke-Bumpus tows was used to quantify seasonal abundance and reveal changes in horizontal distribution (patchiness) of the Polyphemus population in Stonehouse Pond, Barrington, N.H., during 1975 and 1976. Seasonal abundance was typified by an exponential rise to a spring maximum, followed by an exponential decline to a summer plateau. A slight secondary peak occurred in August of each year, and abundance declined to zero in late fall. Two sexual (at the spring abundance maximum and in mid-fall) and three parthenogenetic (early spring, a long summer period, and late fall) periods of reproduction occurred. Gamogenetic brood size was significantly smaller in the spring (2.17 + over - 0.46) than in the fall (3.96 + over - 0.23). Population growth rates were characterized primarily by changes in natality associated with these alternating reproductive modes. The timing of gamogenesis with the spring abundance maximum resulted in greater resting egg production in the spring than in the fall. In both sexual periods, resting egg production was large and occasionally the dominant mode of reproduction. In the spring and fall, the total Polyphemus population was found close to shore, while in the summer it was primarily limnetic in distribution. However, mean densities were usually greater and patches were typically found in the littoral zone.
W79-09836

DISTRIBUTION OF PHYTOPLANKTON IN LOUISIANA LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
V. W. Lambou, F. A. Morris, M. K. Morris, W. D. Taylor, and L. R. Williams.
Report No. EPA-600/3-79-064, Ecological Research Series, June 1979. 74 p, 40 tab, 12 ref, 2 append.

Descriptors: *Phytoplankton, *Louisiana, *Aquatic microbiology, *Eutrophication, Trophic level, Lake stages, Water pollution effects, Water quality, Sewage effluents, Water sampling, Diatoms, Algae.

The species and abundance of phytoplankton in 19 Louisiana lakes sampled during the National Eutrophication Survey in the spring, summer, and fall of 1974 are presented. Phytoplankton data were collected and analyzed in an effort to determine relationships between algal characteristics and trophic status of lakes. All lakes sampled: (1) were impacted by one or more municipal sewage treatment plant outfalls, (2) were 40 hectares or larger, and (3) had a mean hydraulic retention rate of at

least 30 days. At each site, a depth-integrated phytoplankton sample was taken. Normally, a lake was sampled three times during the year. Samples were concentrated and examined by microscope. A general phytoplankton list for all of the lakes is provided. All of the phytoplankton data collected are summarized by lake including an alphabetical phytoplankton species list with concentrations for individual species given by sampling date. Results from the application of several indices, (Nygaard's Trophic State, Palmer's Organic Pollution, and species diversity and abundance) are also presented for each of the 19 lakes. (Seigler-IPA)
W79-10026

DISTRIBUTION OF PHYTOPLANKTON IN SOUTH DAKOTA LAKES,
Environmental Monitoring and Support Lab., Las Vegas, NV. Monitoring Operations Div.
S. C. Hern, V. W. Lambou, F. A. Morris, M. K. Morris, and W. D. Taylor.
Report No. EPA-600/3-79-069, Ecological Research Series, June 1979. 88 p, 66 tab, 12 ref, 2 append.

Descriptors: *Phytoplankton, *South Dakota, *Aquatic microbiology, *Eutrophication, Trophic level, Lake stages, Water pollution effects, Water quality, Sewage effluents, Water sampling, Diatoms, Algae.

The species and abundance of phytoplankton in 31 South Dakota lakes sampled during the National Eutrophication Survey in the spring, summer, and fall of 1974 are presented. Phytoplankton data were collected and analyzed in an effort to determine relationships between algal characteristics and trophic status of lakes. The screening and selection of lakes to be sampled strongly emphasized lakes with actual or potential accelerated eutrophication problems. As a result, all the sampled lakes: (1) were impacted by one or more municipal sewage treatment plant outfalls; (2) were 40 hectares or larger in size; and (3) had a mean hydraulic retention time of at least 30 days. At each sampling site, a depth-integrated phytoplankton sample was taken. Normally, a lake was sampled three times during the year. Permanent slides were prepared from concentrated samples and examined by microscopic techniques. A general phytoplankton list for all the lakes is provided. All of the phytoplankton data collected are summarized by lake including an alphabetical phytoplankton species list with concentration for individual species given by sampling data. Results from the application of several indices, (Nygaard's Trophic State, Palmer's Organic Pollution, and species diversity and abundance) are also presented for each of the 31 lakes. (Siegler-IPA)
W79-10027

2I. Water In Plants

MAGNESIUM UPTAKE FROM EXCHANGEABLE AND NONEXCHANGEABLE SOURCES IN SOILS AS MEASURED BY INTENSIVE CROPPING,
Michigan State Univ., East Lansing. Dept. of Crop and Soil Sciences.
D. R. Christenson, and E. C. Doll.
Soil Science, Vol. 126, No. 3, p 166-168, September, 1978. 4 tab, 6 ref.

Descriptors: *Magnesium, Nutrients, Mineralogy, Greenhouses, *Nutrient removal, Oats, Michigan, Plant growth.

Several soils were cropped with four consecutive crops of oats (Avena sativa, 'Garry') in the greenhouse. Changes in exchangeable Mg levels were used to indicate uptake from that source. The remainder of the uptake was attributed to the nonexchangeable source. Total uptake by the four crops did not appear to be related to total Mg level in the soil, percent clay in the soil, or exchangeable Mg level. Mg availability did appear to be related to the mineralogy of the medium clay fraction. (Skogerboe-Colorado State)
W79-09908

RESPONSE OF NATIVE GRASSLAND LEGUMES TO WATER AND NITROGEN TREATMENTS,
Colorado State Univ., Fort Collins. Natural Resource Ecology Lab.
W. K. Lauenroth, and J. L. Dodd.
Journal of Range Management, Vol. 32, No. 4, p 292-294, July 1979. 2 fig, 1 tab, 15 ref.

Descriptors: *Crop response, *Nitrogen fixation, *Legumes, *Moisture availability, *Nutrient requirements, *Nitrogen cycle, *Environmental effects, *Soil-water-plant relationships, Grasslands, Productivity, Biomass, Great Plains.

Although grassland nitrogen-fixing plants occupy an important position in the nitrogen cycle of the semiarid Great Plains grasslands, little has been known about the ecology or functional significance of these native legumes. With the purpose of providing basic phytosociological data for legumes under ambient environmental conditions, native shortgrass prairie legumes were subjected to the experimental manipulation of soil water and mineral nitrogen availability at the Pawnee experimental site 61 Km northwest of Fort Collins, Colorado. In this experiment, initiated in 1970, a factorial design with two water and two nitrogen treatments was employed on two sets of four one-ha plots consisting of a control, water, nitrogen, and water-plus-nitrogen treatments. A total of seven species of legumes was encountered during the study period, the largest number on the water-treated plots where legume densities increased each year of the study and in 1974 were approximately 30 times greater than the control. Above-ground biomass and density measurements substantiated the success of legumes under conditions of increased water availability presumably because of the more favorable conditions for nitrogen fixation and increased competitive advantage under nitrogen deficient conditions. (Tickes-Arizona)
W79-10071

2J. Erosion and Sedimentation

WATER QUALITY CHARACTERISTICS OF THE HORSE CREEK WATERSHEDS IN NORTH CENTRAL IDAHO,
Idaho Univ., Moscow.
For primary bibliographic entry see Field 2A.
W79-09838

CONSEQUENCES OF HARVESTING AND SITE PREPARATION IN THE PIEDMONT,
Georgia Univ., Athens. School of Forest Resources.
For primary bibliographic entry see Field 5A.
W79-09878

APPLICATION OF INFINITE SLOPE ANALYSIS TO SUBAQUEOUS SEDIMENT INSTABILITY, MISSISSIPPI DELTA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
For primary bibliographic entry see Field 2L.
W79-09970

A DIRECT OBSERVATION TECHNIQUE FOR THE STUDY OF MICROORGANISMS IN SEDIMENT SAMPLES,
Waterloo Univ. (Ontario). Dept. of Biology.
D. R. Polonenko, C. I. Mayfield, and W. E. Inniss.
Water, Air, and Soil Pollution, Vol. 11, No. 2, p 237-245, February 1979. 3 fig, 3 tab, 14 ref.

Descriptors: *Microorganisms, *Sediments, *Microscopy, Laboratory tests, Microbiology, Analytical techniques, Nutrients, Toxins, Biology, Lakes, Lake sediments.

A technique was described for the incubation of sediment samples under controlled conditions and the examination of the sediment by direct microscopy after percolation with a fluorescent stain--the ammonium salt of 8-anilino-1-naphthalenesulfonic acid. The incubation chamber employed enabled the sediment sample to be treated by percolation with nutrients or with toxic chemicals. The response of the sediment microorganisms to these amendments could be analyzed using pattern determination statistics or direct counts at intervals during incubation. (Sims-ISWS)
W79-09982

2K. Chemical Processes

SOME EFFECTS OF UREA FERTILIZATION ON A FORESTED WATERSHED IN WEST VIRGINIA,
Northeastern Forest Experiment Station, Parsons, WV.
J. H. Patric, and D. W. Smith.
In: Central Hardwood Forest Conference, Proceedings of the Second Meeting, Purdue University, P. E. Pope, editor, p 210-227, 1978. 4 tab, 17 ref.

Descriptors: Ammonia, Calcium, Forestry, Interception, Magnesium, Nitrates, Phosphates, Potassium, Rainfall, *Small watersheds, Specific conductance, Water yield, *Urea, Central Appalachians, *Forest fertilization, West Virginia.

A 75-acre watershed on the Fernow Experimental Forest, near Parsons in West Virginia, was fertilized in May 1971 with 500 pounds of urea per acre. It had a dense stand of 12-year-old hardwood sprouts and seedlings, natural regrowth after clear-cutting in 1958. The effects on soil-plant-water relations have been observed since fertilization. Soil content of total nitrogen, phosphorus, potassium, calcium, and magnesium was unchanged except for nitrogen, which was significantly lower on southslope soils during 1972 and 1973. Analyses of yellow-poplar buds for the same nutrients showed significantly increased content of nitrogen but only in 1972. A significant streamflow decrease of 1.23 inches accompanied a throughfall decrease of 0.89 inch in 1972. There was no change in stream pH. Increased specific conductance after fertilization reflected temporarily increased stream content of calcium (3 years), nitrate (2 years) and of magnesium and sodium (1 year). Sulfate content of the stream decreased, but only in 1971. The disposition of urea-N is reckoned as about 20 percent lost to streamflow, up to 50 percent volatilized, 5 percent remaining in the standing phytomass, and the balance probably mobile in the soil and associated organic matter. (Forest Service)
W79-09847

CATION EXCHANGE EQUILIBRIA IN FLORIDA AND INDIANA HISTOSOLS,
Purdue Univ., Lafayette, IN.
V. C. Baligar, S. A. Barber, and D. L. Myhre.
Soil Science, Vol. 125, No. 2, p 109-117, August, 1978. 2 fig, 4 tab, 31 ref, 8 equ.

Descriptors: *Cation exchange, Organic soils, Cation adsorption, Potassium, Isotherms, Soil chemistry, Florida, Indiana.

Ion exchange equilibria have been investigated in mineral soils, but little information is available for organic soils. This investigation was undertaken to characterize the cation selectivity of differing histosols and to determine a suitable cation exchange equation to express the ion selectivity in these soils. Four histosols were incubated for 3 weeks with 5 levels of K and Rb. At the end of incubation, ions in soil solution and on the adsorbed phase were determined. All soils had a greater fraction of Ca in the exchange phase than in solution, whereas with Mg, Na, K, and Rb, the reverse occurred. Increasing K and Rb saturation was related to an increase in selectivity coefficient for Rb-K. On the Pahokee muck soils, Rb was adsorbed more tightly than K, where the amount of Rb added exceeded 1.0 me/100 g of soil. On the Edwards muck soil, Rb was adsorbed preferentially to K at all levels. Magnesium was adsorbed preferentially to Ca on the Edwards muck soil, but not on the Pahokee soils. Selectivity coefficients for K-Ca were calculated using the Kerr, Gapon, Krishnamoorthy and Overstreet, Vanselow, and Scheffer and Ulrich equations. In all but the Scheffer and Ulrich equation, the selectivity coefficient decreased as K and

Rb were increased. In the latter it increased. No equation satisfactorily described the system. (Skogerboe-Colorado State)
W79-09912

SOIL WATER CONTENT AND TEMPERATURE AS FACTORS IN THE VOLATILE LOSS OF APPLIED MERCURY (II) FROM SOILS,
Oregon State Univ., Corvallis.
E. R. Landa.
Soil Science, Vol. 126, No. 1, p 44-48, July, 1978. 2 fig, 1 tab, 16 ref.

Descriptors: *Mercury, Volatility, Soil contamination, *Moisture content, *Soil temperature, Pollutant identification, Water pollution sources.

Five surface soils from southeastern Montana were studied to determine the effects of soil water content and temperature on the volatile loss of applied divalent inorganic mercury. Soils were amended to 1 ppm Hg as 203 Hg-Hg(NO3)2. The water content studies involved soil samples at room temperature (18-25 C), either allowed to air-dry or maintained near the 1/3-bar or the 80 percent saturated moisture levels. The temperature studies involved samples at the 1/3-bar moisture level maintained at either 10 C, room temperature, or 35 C. Residual Hg content was monitored for 5-7 weeks. Hg losses were higher at the 1/3-bar moisture content than at air-dryness or 80 percent saturation. At 35 C the initial Hg loss rate was accelerated with respect to room temperature, while at 10 C, losses were considerably reduced. (Skogerboe-Colorado State)
W79-09916

METHODOLOGY OF STUDIES ON CHEMICAL PROCESSES IN WATER RUNOFF FROM ROCK AND SHALLOW SOIL COVER USING RADIOACTIVE TRACERS,
Institutt for Atomenergi, Kjeller (Norway).
J. B. Dahl, C. Qvenild, O. Tollan, N. Christophersen, and H. M. Seip.
Water, Air, and Soil Pollution, Vol. 11, No. 2, p 179-190, February 1979. 7 fig, 5 tab, 19 ref.

Descriptors: *Water chemistry, *Runoff, *Simulated rainfall, Soils, Rocks, Weathering, Adsorption, Tracers, Vegetation, Vegetation, Vegetation effects, Tritium, Calcium, Sulfur, Bromine, Isotope studies, On-site investigations, *Norway.

Studies of flow patterns and chemical processes in water runoff from small plots (natural 'fields' with an area of about 5 sq m) have been carried out. Simulated rain containing radioactive tracers, i.e., T (as HTO), Ca (45Ca(2+)), S (35SO4(2-)), and Br (82Br(-)) was distributed with an intensity of about 10 mm/h. Calcium ions are strongly adsorbed by soil or taken up by vegetation in most cases; even on rocks covered only by sparse lichens, the adsorption is considerable. The total Ca concentration in the runoff is, nevertheless, often higher than in the artificial precipitation. Sulphate ions follow T rather closely. However, the ratio of 35SO4(2-) to T concentrations in the runoff may differ somewhat from the value in the precipitation. Ratios above one were found in the experiment on 'barren' rock and during the first stage of the other experiments. (Sims-ISWS)
W79-09980

INTERACTION BETWEEN SIMULATED RAIN AND BARREN ROCK SURFACE,
Norske Skogforsoksvesen, Oslo.
G. Abrahamsen, A. Stuanes, and K. Bjor.
Water, Air, and Soil Pollution, Vol. 11, No. 2, p 191-200, February 1979. 6 fig, 2 tab, 14 ref.

Descriptors: *Water chemistry, *Runoff, *Acidic water, *Simulated rainfall, Rocks, Granites, Acidity, Salts, Ions, Cations, Anions, Hydrogen ion concentration, Lichens, On-site investigations, *Norway, Acid rainfall.

During the latter decades extensive fish kills have been observed in the mountainous areas of southernmost Norway. These kills have been attributed to the increased acidity of the river water. The increased acidity is generally assumed to be caused by acid precipitation. However, the relationship between precipitation and runoff quality is very complex. This paper was concerned with the relationship between chemical composition of simulated rain and that of runoff from bare granitic rock, partly covered by lichens. When supplying simulated rain with a pH value of approximately 5, the very first runoff had pH values between 4.1 and 4.3. However, the pH in the runoff increased rapidly and leveled out at values between 4.6 and 4.7. When supplying simulated rain with pH approximately 3.5, the pH in the first runoff varied between 3.8 and 3.6. The pH then gradually decreased to the same values as those in the simulated rain. Runoff from 'rain' with pH 4.3 obtained the same pH value as that of the 'rain'. The pH of the runoff was dependent not only on the rain acidity, but also on its content of neutral salts. (Sims-ISWS)
W79-09981

BORON DISTRIBUTION IN SOILS AND WATERS OF EGYPT,
California Univ., Riverside. Dept. of Soil and Environmental Sciences.
A. A. Elseewi, and A. E. Elmalky.
Soil Science, Vol. 43, No. 2, p 297-300, March-April, 1979. 4 fig, 3 tab, 17 ref.

Descriptors: *Boron, *Chemical analysis, *Water chemistry, *Environmental effects, *Soil physical properties, Salinity, Soil texture, Soil profiles, Nile Delta, Egypt, Toxicity, Hydrogen ion concentration, Sampling.

Boron, which can accumulate to harmful levels in arid and semi-arid regions, has been indicated by preliminary investigations to exist in excessive concentrations in soils and waters in many areas of Egypt. The purpose of the present paper is to present data on the distribution of boron in some Egyptian soils as examples of typical arid zone soils, and to give the relationship between these fractions and some soil parameters such as soil pH, salinity, solid carbonate content, depth and texture. Twenty-six soil profiles from six geographically different sites in the Nile Delta and surrounding deserts were analyzed and sampled at consecutive depths of 0-30, 30-60 and 60-90 cm. Samples of Nile irrigation and drainage water also were collected and analyzed. A summary of physical, chemical and boron analysis of the soil and water samples collected indicated that saturation extract and hot water soluble boron averaged 0.6 mg/ml and 1.3 mg/g respectively, while acid soluble and total boron averaged 10.2 and 113 mg/g. Total boron concentrations were on the average twice as high in clay samples as in sandy soils and decreased by 32% lower than 60 cm in the soil profile. Boron concentrations in Egyptian soils were above the sufficiency level or were similar to or a reasonable multiple of Nile water boron concentrations, indicating that under proper management, boron toxicity can be controlled. (Tickes-Arizona)
W79-10073

2L. Estuaries

THE DISTRIBUTION AND SEASONALITY OF THE BENTHIC AQUATIC MACROPHYTES OF THE PAMLICO RIVER ESTUARY, NORTH CAROLINA,
East Carolina Univ., Greenville, NC. Dept. of Biology.
S. E. Reed.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 496, Price codes: A04 in paper copy, A01 in microfiche. M. S. Thesis January 1979. 55 p, 9 fig, 8 tab. OWRT A-077-NC (11), 14-31-0001-5033.

Descriptors: *Benthic flora, *Macrophytes, Seasonal growth, *Submerged plants, Plant distribution, Plant growth, Estuaries, Pamlico River.

The distribution and seasonal dynamics of the submersed vascular plants and macroscopic algae of the Pamlico River estuary, North Carolina, were studied from 7/73-8/74. Plants were restricted mainly to the sandy shallow margins in the upper two-thirds of the estuary with most of the biomass around 1 m depth. The estuary was divided into oligo-, meso- and polyhaline zones based on a rather unstable salinity gradient. In the oligohaline zone macrophyte communities consisted of Vallisneria americana, Potamogeton perfoliatus var. bupleuroides, Najas guadalupensis, and the muskgrasses Chara sp. and Nitella sp.; the mesohaline zone included V. americana, P. perfoliatus and Ruppia maritima; and some sheltered low energy environments of the polyhaline zone had small amounts of R. maritima. Line transects were used to sample biomass and community species composition during the seasonal studies. Salinity varied between 1 and 16 ppt depending on the rate of freshwater discharge from the Tar River, the principal tributary. Water temperature closely paralleled air temperature, ranging between 5 and 30 degrees C. During the summer and early fall, the dominant macrophyte was Vallisneria americana, accounting for 80-90% of the total macrophyte biomass in the estuary. Ruppia maritima was dominant during the low temperatures of the winter months and in regions of high salinity, but at low biomass levels. Maximum biomass was recorded in September and October with minimal biomass occurring in February. Compsopogon coeruleus, a red filamentous algae, appeared in nuisance proportions in the oligo-mesohaline area during early summer; the green algae Cladophora sp. and Enteromorpha sp., reached maximum biomass later in the season. (Kiger-North Carolina)
W79-09834

APPLICATION OF INFINITE SLOPE ANALYSIS TO SUBAQUEOUS SEDIMENT INSTABILITY, MISSISSIPPI DELTA,
Louisiana State Univ., Baton Rouge. Coastal Studies Inst.
D. B. Prior, and J. N. Suhayda.
Engineering Geology, Vol. 14, No. 1, p 1-10, June 1979. 4 fig, 1 tab, 22 ref.

Descriptors: *Deltas, *Mississippi River, *Slope stability, *Beds, Sediments, Pore pressure, Analysis, Analytical techniques, Landslides, Sedimentation, Slopes, Geomorphology, Submarine landslides.

Submarine landslides were described on very low angle slopes (0.5 deg-1.7 deg) in the Mississippi prodelta area and were evaluated using infinite slope analysis. For instability to occur, pore water pressure ratios in excess of hydrostatic pressure and approaching geostatic pressure are needed. These calculated values, based on 3 sets of effective strength parameters and for 2 sediment depths to failure, are in close agreement with measured pore water pressure data from in situ piezometers. Ratios of geostatic pressure as large as 0.986 have been monitored. Mud vents are also indicative of large internal pressures within the sediments, generated by rapid sedimentation, wave perturbation, and biogenic methane. The analysis suggested that the reduction in effective stress may be sufficient to cause failure by gravitational stresses alone. (Humphreys-ISWS)
W79-09970

EXPERIMENTAL CONTROL OF BEACH FACE DYNAMICS BY WATERTABLE PUMPING,
Australian National Univ., Canberra (Australia). Dept. of Geography.
J. Chappell, I. G. Eliot, M. P. Bradshaw, and E. Lonsdale.
Engineering Geology, Vol. 14, No. 1, p 29-41, June 1979. 6 fig, 12 ref.

Descriptors: *Beach erosion, *Deposition(Sediments), *Water table, *Pumping, *Tidal effects, Water level fluctuations, Sand bars, Sedimentation, Beaches, Wells, Model studies, Rip currents, Infiltration, Swash, Backwash, Hele-Shaw models.

The dynamic sediment budget on the intertidal face of sandy surf beaches is influenced by interaction of swash/backwash flows with the beach wa-

tertable. Watertable height variations are coupled to tides and pass into the beach as a slow wave of diminishing amplitude and increasing lag. High-frequency pulses from the onshore wave train also propagate into the beach. The height at which the watertable outcrops on the beach face is affected by antecedent tide and wave history and influences balance of sand deposition and entrainment during swash and backwash. Experimental lowering of the watertable by pumping an array of wells induces sand deposition. Energy expended in pumping is less than 0.3% of the onshore flux in the wave train. (Visocky-ISWS)
W79-09971

DISPERSION IN THE UPPER DELAWARE ESTUARY,
Rutgers - The State Univ., New Brunswick, NJ. Coll. of Engineering.
R. C. Ahlert, R. L. Peskin, R. Vichnevetsky, and F. Henry.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 595, Price codes: A02 in paper copy, A01 in microfiche. Final Technical Completion Report for Project A-044-NJ, Water Resources Research Institute, Rutgers University, New Brunswick. 13 pages, June 1979, 1 tab, 10 ref. OWRT A-044-NJ (1), 14-34-0001-9032.

Descriptors: Estuaries, Dispersion, Mathematical models, Hydrology, Fate of pollutants, Mixing, Currents, Convection, Turbulence, Computer models, Pollutant transport.

The final objective of this work was to characterize the scales of transport occurring in the Upper Delaware Estuary (UDE), using simple numerical models. The estuary can be considered quasi-two-dimensional; the depth scale is much smaller than the width and length scales. However, the bottom roughness must be accounted for, as this is the major mechanism for removal of energy from the flow system. A three-channel model was constructed so that some two-dimensional features of estuarine flow could be studied, while retaining the simplicity of the one-dimensional approach. It became evident that it was numerically desirable to split the problem into two parts; a hydraulic model and an advection-diffusion, transport model. The hydraulic model output was compared to date published by the USGS. The data consisted of daily average volume flow rates at Trenton and hourly values of tidal elevation for three gauging stations within the test length. The transport model was tested against data taken from USEPA Tech. Report No. 62 (1978). The data was for a dye study performed in 1974 by USEPA at the Northeastern Philadelphia Wastewater Treatment Plant. The hydraulic model also predicted the existence of large-scale horizontal circulations. These intratidal motions would enhance the mixing of pollutants across the estuary. It is assumed these lateral motions are largely a product of changes in estuary geometry, with downstream distance. The longitudinal dispersion parameter is usually modeled using the depth as the characteristic length scale.
W79-10021

3. WATER SUPPLY AUGMENTATION AND CONSERVATION

3A. Saline Water Conversion

PRETREATMENT OF SEAWATER FOR REVERSE OSMOSIS PROCESSES: 1976,
Permutit Co., Princeton, NJ.
A. C. Epstein.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 509, Price codes: A08 in paper copy, A01 in microfiche. Report proposed for Office of Water Research and Technology (1979) 106 p, 27 fig, 18 tab, 21 ref, 7 append. OWRT (no. 3242)(1), 14-30-3242.

Descriptors: *Desalination, *Membrane processes, *Reverse osmosis, Seawater, Water treatment, Seawater pretreatment, Spiral wound membrane, Thin film composite membranes, Hollow fiber polyamide membrane, Wrightsville Beach, NC.

A field test program was conducted in 1976 (at the Office of Water Research and Technology's Wrightsville Beach Test Facility, Wrightsville Beach, N.C.) of three seawater pretreatment systems which precede reverse osmosis systems. The three pretreatment systems tested were: (1) The OWRT's so-called baseline system which consisted of sand filtration followed by manganese zeolite filtration followed by cartridge filtration. A carbon filter was also included for chlorine removal ahead of the hollow fiber polyamide membrane. (2) A coagulation pretreatment system which consisted of an upflow sludge blanket precipitator followed by a polishing filter and a cartridge filter. A carbon filter was also included in this system for removal of chlorine ahead of the hollow fiber polyamide membrane. (3) In-line coagulation performed ahead of the base-line pretreatment system. The feed to all three systems was chlorinated/microscreened seawater. The pretreated effluent from systems (1) and (2) was used as feed to either a spiral wound thin film composite membrane or a hollow fiber polyamide membrane. Reverse osmosis performance was not evaluated on in-line coagulated water. Systems (2) and (3) provided water with acceptable plugging factors for feeding reverse osmosis systems; system (1) did not. The economics of the three pretreatment systems (in 1976 costs) were determined for a flow rate of 4 million gallons per day. (Easton-OWRT)
W79-09831

DEVELOPMENT OF DRY PROCESS MICROPOROUS POLYSULFONE SUPPORTS FOR ULTRATHIN FILM COMPOSITES,
Chemical Systems, Inc., Tustin, CA.
R. E. Kesting.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 488, Price codes: A03 in paper copy, A01 in microfiche. Final Report prepared for the Office of Water Research and Technology, July 15, 1978-July 15, 1979. 31 p, 2 fig, 4 tab, 24 ref. OWRT (no. 8537)(1), 14-34-0001-8527.

Descriptors: *Membranes, *Films, *Thin films, Permselective membranes, Membrane processes, Wettability, Evaporation control, Porosity, Chemistry, Cellulose, Castings, Viscosity, Desalination, Reverse osmosis, Polysulfone, Polybutylene terephthalate, Dry process.

Ultrathin film composite (UTF) membranes are skinned membranes consisting of thin dense skin and a thick porous substructure. UTF origins in integrally skinned (asymetric) membranes are traced and different types of UTF membranes are described. A dry process microporous support of polybutylene terephthalate (P13T) was developed. It appears to be superior to wet process polysulfone membranes because: (1) PBT membranes are more solvent resistant, (2) PBT membranes are wet-dry reversible due to traces of polyvinylalcohol (PVA), (3) PBT membranes solvent cast onto polyethylene terephthalate (PET) forms an integral bond and cannot be removed inadvertently during handling or operation, and (4) PBT membranes have the optimum high density of 0.1 millimicron pores. The best results were obtained with PBT (6 PRO Eastman) 5g, polyvinyl alcohol (Gelvatol 20-30 Monsanto) 5g, HFIP 90g. This solution was cast 0.02 in. thick onto Eaton-Dikeman 3381 PET nonwoven fabric to yield a support membrane 0.002 in. thick. This PBT membrane appears to be ideal for further development as a UTF support material. A second accomplishment was the development of a one step dry process for casting PS membranes. (Seigler-IPA)
W79-09839

LONG TERM EXPERIMENTS ON SEA WATER DESALINATION AT THE CHIGASAKI LABORATORY,
Water Reuse Promotion Center, Tokyo (Japan).
Y. Kunisada, and Y. Murayama.
Desalination, Vol. 27, No. 3, p 333-344, December 1978. 10 fig, 1 tab, 2 ref.

Descriptors: *Sea water, *Desalination, *Reverse osmosis, *Performance, *Domestic modules, Long-term planning, Desalination plants, Hollow-fiber module, Tubular module, Spiral-wound module, Membrane durability, Japan, Stability, Permeability, Pretreatment.

The technology of producing fresh water from sea water by the reverse osmosis (RO) process has been developed since 1974 under the supervision of the Ministry of International Trade and Industry. Highly satisfactory and stable performances have been recorded for the two-stage desalination process using RO modules developed in Japan. Durability of the membranes under testing is expected to last more than three years. The quality of the product water can be kept below TDS 200 ppm that is suitable for potable consumption. Construction of a demonstration plant of 500 cu m/day using domestic modules is now being planned. (Bell-Graf--Cornell)
W79-09871

ENGINEERING MANAGEMENT OF NUCLEAR DESALINATION PLANTS--A CASE STUDY, SAUDI ARABIA,
Iowa State Univ., Ames. Engineering Research Inst.
A. F. Abdul-Fattah, and A. A. Husseiny.
Desalination, Vol. 27, No. 3, p 283-331, December 1978. 15 fig, 16 tab, 37 ref.

Descriptors: *Desalination plants, *Engineering management, *Nuclear energy, *Powerplants, *Organization, *Manpower, *Saudi Arabia, Projects, Programs, Planning, Capital, Staffing, Non-nuclear countries, Decentralization.

Engineering management and manpower aspects of potential nuclear desalination projects in non-nuclear countries are considered herein with emphasis on safety and quality assurance. Detailed investigation is made of manpower and staffing requirements of dual-purpose nuclear power and desalination plants. Organization and management of typical overall nuclear programs and individual plants are studied to provide specific recommendations of procedures compatible with countries having little or modest industrial activity. Saudi Arabia was selected as a specific case for this study; however, the results apply generally to countries at the same industrial development level. The case of Saudi Arabia is of interest due to the peculiarities of a shortage in human capital and a lack of industries necessary to support desalination and nuclear energy activities. A critical review is made of organization and management models which have been used in business, industry, and government. Examined is the viability of the following models for implementation of nuclear energy projects involving electrical power generation and saline water conversion in non-nuclear countries: bureaucratic model; classical model; semi-classical model: neoclassical concepts; decision-making model; and modern management model. (Bell-Graf--Cornell)
W79-09872

THE WORLD'S FIRST LARGE SEAWATER REVERSE OSMOSIS DESALINATION PLANT, AT JEDDAH, KINGDOM OF SAUDI ARABIA,
Ministry of Agriculture and Water, Riyadh (Saudi Arabia).
A. Al-Gholaikah, N. El-Ramly, I. Jamjoom, and R. Seaton.
Desalination, Vol. 27, No. 3, p 215-231, December 1978. 4 fig, 4 tab.

Descriptors: *Desalination, *Desalination plants, *Reverse osmosis, *Jeddah(Saudi Arabia), Design, Evaluation, Capital costs, Installations, Logistics, Operation and maintenance, Costs, Distillation, Delivery times, Multiflash distillation, Sea water.

Traditionally, coastal urban centers in arid areas have had to rely on distillation for the desalting of seawater. But there is now a new alternative, as exemplified by the current installation of a large reverse osmosis plant to desalt highly saline Red Sea water to supply municipal water needs at Jeddah, Saudi Arabia. The Saline Water Conver-

sion Corporation of the Kingdom of Saudi Arabia awarded a competitively-bid contract to Fluid Systems Division of UOP Inc. for the design, fabrication, construction and two-year operation and maintenance of a seawater reverse osmosis desalting plant with a production capacity of 12,000 cu m/day. This paper presents a comprehensive review and description of the design, logistics and installation aspects of the plant together with an evaluation of delivery times and capital and operating costs of reverse osmosis vis-a-vis multiflash distillation for seawater desalination. (Bell-Graf--Cornell)
W79-09873

LAS PALMAS PHASE II DESALINATION PLANT IN THE CANARY ISLANDS (SPAIN),
Babcock and Wilcox Expanola S.A., Madrid (Spain).
J. Guzman.
Desalination, Vol. 27, No. 2, p 175-187, November 1978. 5 fig.

Descriptors: *Desalination plants, *Canary Islands(Spain), Projects, Desalination, Economics, Water costs, Corrosion control, Scale control, Water supply, Construction, Evaporators, Production costs, Amortization costs.

The principal features of the desalination plant Las Palmas Phase II in the Canary Islands are described. Two plants are of the multi-stage flash cross-flow acid-dosing type with a nominal capacity of 9000 cu m/day each. The steam supply is provided by the existing power station. A description of the criteria adopted for the prevention of corrosion is mentioned and a review is given of the main materials used. The economics of the cost of water from this plant are considered. (Bell-Graf--Cornell)
W79-09874

WATER FACTORY 21 DESIGN AND OPERATING DATA,
Orange County Water District, Fountain Valley, CA.
For primary bibliographic entry see Field 5D.
W79-09961

PROCESS FOR SCALE CONTROL USING MIXTURES OF POLYCATIONIC AND POLYANIONIC POLYMERS,
American Cyanamid Co., Samford, CT. (Assignee).
R. M. Goodman.
U.S. Patent No. 4,147,627, 6 p, 10 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 1, p 238, April 3, 1979.

Descriptors: *Patents, *Water treatment, *Water quality control, *Desalination processes, Scaling, Saline water, Evaporators, Desalination apparatus, Magnesium hydroxide.

Although evaporative desalination units are potentially efficient in the desalination of sea waters and waters of high salt contents, the rapid formation of magnesium scaling or sludging reduces efficiency, necessitating shut-down and scale or sludge removal from the desalination units. It has been found that magnesium hydroxide scale formation in evaporative desalination units is inhibited by adding to the saline water being processed a mixture of certain polycationic and polyanionic polymers. (Sinha-OEIS)
W79-10072

3B. Water Yield Improvement

MINIMIZING THE SALT BURDEN OF IRRIGATION DRAINAGE WATER IN THE PECOS VALLEY OF NEW MEXICO.
New Mexico State Univ., Las Cruces. Dept. of Agronomy.
J. G. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 516, Price codes: A04 in paper copy, A01 in microfiche. Master of Science Thesis, 1979. 56 p, 11 fig, 12 tab, 30 ref. OWRT A-056-NMEX (1), 14-34-0001-7066.

Descriptors: *Irrigation practices, Management, *Leaching, Salt balance, Drainage water, Soil management, Salts, Leachate, Pecos River Valley.

Pecos River water has been reported to be ideally suited for minimized leaching. Results of this study appear to support these findings. Reducing leaching fractions decreased irrigation water requirement and lowered the salt burden of drainage water. These reductions were effected without detrimentally affecting soil chemical and physical properties and without reducing crop yields. Soil and drainage data appeared to validate the applicability of the U.S. Salinity Laboratory's chemical computer model to Pecos Valley conditions.
W79-09837

CAN FOREST LAND PRODUCE WOOD, RECREATION, AND HIGH QUALITY WATER TOO,
Northeastern Forest Experiment Station, Parsons, WV.
For primary bibliographic entry see Field 4C.
W79-09851

STATE OF THE ART IN MANAGING WATER RESOURCES ON FOREST LAND,
Southeastern Forest Experiment Station, Franklin, NC. Coweeta Hydrologic Lab.
J. E. Douglass.
In: Proceedings Western North Carolina Research-Resource Management Conference, September 14-16, 1977, Asheville, North Carolina, p 56-60, 1977. USDA Forest Service, Southeastern Forest Experiment Station, Asheville, North Carolina. 16 ref.

Descriptors: *Water supply, *Forested watershed, *Water quality, *Flow duration, *Flow augmentation, Water yield, Southern Appalachian Mountains, Blue Ridge Mountains.

This paper deals with the yield, timing, and quality of water flowing from forested watersheds of the southern Appalachians and how these parameters are changed by management activities. (Forest Service)
W79-09880

3C. Use Of Water Of Impaired Quality

A STUDY OF THE REUSE OF REUSED WATER,
Construction Engineering Research Lab. (Army), Champaign, IL.
E. D. Smith, R. M. Sweazy, G. A. Whetstone, and R. H. Ramsey.
Ground Water, Vol. 17, No. 4, p 366-374, July-August 1979. 5 fig, 4 tab, 14 ref. OWRT C-6053(no. 5205) (4), 14-31-0001-5205.

Descriptors: *Water reuse, *Irrigation water, *Lakes, *Water wells, *Texas, Water quality, Reclaimed water, Sewage effluents, Irrigation, Nutrients, Agriculture, Recreation facilities, Model studies, Hydraulic models, Algae, Bacteria, Fish, Urban runoff, Impaired water use, *Lubbock(TX), *Lubbock Canyon Lakes.

Lubbock is located in the center of the semiarid High Plains of Texas. Due to a shortage of adequate water-based recreational facilities in the region, the City Planning Department developed a scheme for converting an 8-mile intracity canyon into a linear park containing a series of small recreational lakes. Funds amounting to over $11,000,000 were committed to the project by a local bond issue and various governmental organizations. The proposed lake makeup water is unique. Never before has a serious attempt been made to develop recreational lakes utilizing urban runoff and twice-used reclaimed municipal wastewater as the sole source of supply. The majority of the makeup water will be obtained from wells on a farm which has received the major portion of Lubbock's secondary treated sewage since 1938 and used it for irrigation purposes. In order to ascertain the suitability of utilizing this reclaimed sewage effluent for recreational purposes, the Texas Tech University Water Resources Center, with the aid of an OWRT grant, constructed a model system designed to simulate the lake project. Research performed to date includes algal growth potential studies, water quality analyses, bacteriological assays, viral assays, and fish life studies. (Sims-ISWS)
W79-09846

DRAINAGE PRACTICE IN IMPERIAL VALLEY,
Science and Education Administration, Brawley, CA. Imperial Valley Conservation Research Center.
L. F. Hermsmeier.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 21SW, No. 1, p 105-109, February 20, 1978. 1 fig, 7 tab, 10 ref.

Descriptors: *Salinity, *Drainage practices, Drainage programs, Colorado River Basin, Saline water, Salt balance, Colorado River, California.

The Imperial Valley in California has been irrigated by Colorado river water from the start of the century. The irrigation water quality was recognized as presenting possible drainage and salinity problems. As early as in 1902, irrigation engineers of the U.S. Department of Agriculture indicated that the water table and salinity of the valley needed to be controlled. Even to this day, the salinity remains to be a problem in the Imperial Valley. The purpose of this paper was to describe briefly all the drainage studies and developments that have taken place until recent years. It also reports the soil types, climate, drainage cost and the crops grown in the valley. (Skogerboe-Colorado State)
W79-09910

3F. Conservation In Agriculture

INTAKE CHARACTERISTICS OF IRRIGATION FURROWS,
Arizona Univ., Tucson. Dept. of Soils, Water and Engineering.
For primary bibliographic entry see Field 2G.
W79-09909

PREDICTING IRRIGATION RETURN FLOW RATES,
Science and Education Administration, Brawley, CA.
J. A. Bondurant, C. E. Brockway, and M. J. Brown.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 21SW, No. 6, p 1142-1143, December 20, 1978. 2 fig, 2 tab, 4 ref.

Descriptors: *Return flow, Sediment load, *Sediment distribution, Streamflow, Design flow.

Return flows from irrigated areas in southern Idaho were analyzed and a relationship was developed that characterizes flows by relating the cummulative percent of total seasonal flow to maximum flow rate. Since maximum flow rate can be estimated from channel characteristics and flow evidence, it was suggested that design flow rates' sediment ponds can be selected where flow records are not available. (Skogerboe-Colorado State)
W79-09913

THE ROLE OF EVAPOTRANSPIRATION MODELS IN IRRIGATION SCHEDULING,
Science and Education Administration, Kimberly, ID. Snake River Conservation Research Center.
For primary bibliographic entry see Field 2D.
W79-09914

ESTIMATING SPRINKLER DISTRIBUTION PATTERNS USING LINEAR REGRESSION,

Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
D. Karmeli.
Transactions of the American Society of Agricultural Engineers, Special Edition, Vol. 21SW, No. 4, p 682-686, August 20, 1978. 5 fig, 2 tab, 5 ref.

Descriptors: *Sprinkler irrigation, Distribution patterns, Estimating equations, *Regression analysis, Spatial distribution.

The linear regression was used to describe sprinkler distribution patterns. The linear fit was found to approximate the distribution very well in a wide range. This approximation proved to produce good estimates for both high and low quality distributions. In the higher quality distributions, the linear regressions model estimated the actual field data as well as the normal model. However, in lower quality distributions the linear regression model proved significantly better than the normal model in its estimates. A new coefficient, UCL, was suggested for practical use. (Skogerboe-Colorado State)
W79-09915

TRAVELING BOOM SPRINKLER OPERATION IN WIND,
Science and Education Administration, Morris, MN. North Central Soil Conservation Research Center.
H. Shull, and A. S. Dylla.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 3, p 537-539, May-June 1979. 5 tab, 11 ref.

Descriptors: *Irrigation, *Sprinkler irrigation, *Irrigation practices, *Winds, On-site investigations, Equipment, Irrigation systems, Data processing, Distribution patterns, Effects, Agriculture, Traveling boom sprinklers.

Field testing has shown that if suitable travel land spacings are used, a traveling boom sprinkler irrigation system can provide uniform water distribution under low winds. If daily wind speed varies, and exceeds about 2 m/s, no lane spacing will give uniform water distribution under all wind conditions. (Sims-ISWS)
W79-09967

MULTIPLE EMITTER FLOW CONTROL,
M. H. Christy, and L. Spencer.
U.S. Patent No. 4,147,307, 7 p, 18 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 1, p 136, April 3, 1979.

Descriptors: *Patents, *Irrigation, *Flow control, Irrigation efficiency, Irrigation practices, Application equipment, Drip irrigation.

A drip or trickle flow emitter system utilizes a normally flat irrigation flow tube. A series of outlets are fitted with a series of flush-drip emitters capable of extending radially for flush flow. The tube is biased so assume a flattened profile between irrigation cycles so that its wall opposite the outlets applies a force between irrigation cycles so that its wall opposite the outlets applies a force causing the emitters to bend and in bending close the emitters sufficiently to exclude insects and prevent the entrance of exploratory hair roots of plants. The tube expands in response to internal water pressure toward an essentially cylindrical profile to clear the radially inner ends of the emitters and permit expansion to undergo a flush flow phase, followed by collapse to drip flow as the water pressure exceeds a predetermined value. (Sinha-OEIS)
W79-10018

THE ECONOMIC VALUE OF IRRIGATION WATER IN THE WESTERN UNITED STATES,
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.
For primary bibliographic entry see Field 6B.
W79-10023

SCHEDULING TRIMS BACK WATER USE BY 7.3 INCHES PER ACRE,
R. Ross.
Irrigation Age, Vol. 12, No. 9, p 19-20, July-Aug., 1978.

Descriptors: *Scheduling, *Control systems, *Economic feasibility, *Economic justification, *Irrigation practices, Decision making, Operations research, Coordination, Water utilizations, Economic impact, Leaching, Soil-water-plant relationship, Water conservation.

Despite the recent emphasis by irrigators on scheduling to save pumping costs and reduce the occurrence of overpumping to leach nitrates and provide suitable soil moisture conditions, only a small share of the potential savings have yet to be realized. Focusing upon the 800,000 acres in Nebraska which were scheduled for irrigation last year, this analysis illustrates how, with the proper determination of how much and when to apply water to the crop and leach nitrates, the University of Nebraska extension service was able to save 5.8 million acre inches of water in this area in 1977. It is emphasized however that the implementation of advanced irrigation scheduling technology requires people trained and skilled in the basic and practical aspects of maintaining the proper soil-plant-water relationships in the field. The ability to provide such people at the Federal, State, and District levels will determine the success of scheduling as a conservation technique. (Tickes-Arizona)
W79-10070

IRRIGATION WATER CONSERVATION USING WIDE-SPACED FURROWS,
Oklahoma State Univ., Stillwater. Dept. of Agronomy.
J. F. Stone, J. E. Garton, B. B. Webb, H. E. Reeves, and J. Keflemariam.
Journal of the Soil Science Society of America, Vol. 43, No. 2, p 407-411, Mar.-Apr., 1979. 3 tab, 1 fig, 9 ref.

Descriptors: *Irrigation practices, *Furrow irrigation, *Crop response, *Soil water movement, *Environmental effects, Water conservation, Soil texture, Irrigation efficiency, Agronomic crops, Infiltration.

With the purpose of examining the possibility of conserving water through wide-spaced furrow irrigation while maintaining yields at acceptably high levels, studies were conducted with three crops at three locations in Oklahoma over eight growing seasons to compare the results of water applications to narrow- and wide-spaced furrows. Irrigation treatments consisting of several modes of water application included: (1) irrigation of every furrow, (2) irrigation of alternate furrows, and (3) irrigation of alternate furrows alternately. Responses of cotton (Gossypium hirsutum L.) grain sorghum (sorghum bicolor L.) and soybeans (Glycine max L.) indicated that wide-spaced furrows required about half the water of narrow-spaced furrows with no reductions in yield occurring in 9 of 11 trials. Where yield reductions did occur it was noted that atmospheric evaporative demands were high, suggesting the possible critical effect of high winds and low precipitation. It is concluded that the principle of water conservation using wide-spaced furrows required a medium to fine textured soil to ensure that lateral water movement from the furrow was about the same distance as vertical infiltration. (Tickes-Arizona)
W79-10074

SPRINKLER IN THE DESERT,
Central Arid Zone Research Inst., Jodhpur (India).
P. Singh, and Z. D. Kavia.
Indian Farming, Vol. 28, No. 6, p 5-7, September 1978, 1 tab.

Descriptors: *Irrigation efficiency, *Irrigation systems, *Sprinkler irrigation, *Irrigation practices, *Crop response, Economic feasibility, Lateral conveyance structures, Crop production, Irrigation effects, Soil-water-plant relationships, Human resources, Economic impact, India.

Sprinkler irrigation has been studied as an alternative to conventional surface irrigation techniques in arid and semi-arid regions where crop failures frequently result not from short supplies of water but from evaporation, seepage and deep percolation. An operational research project has been conducted by the Central Arid Zone Research Institute at Jodhpur, India to determine the comparative efficiency of sprinkler irrigation systems in a cluster of 5 villages. Reported here are the results of one of these village studies where water was pumped either into a 12.3 x 12.6 x 2.3 M3 cemented pond and conveyed to the fields through open earthen channels under a gravity system, or into a sprinkler system. Results have indicated that the sprinkler system (1) permitted a 100% saving in water and doubled the irrigation command area, (2) economized labor for making channels, ridges, etc., (3) resulted in a 25% additional harvest on a unit area basis and a 150% increase on an irrigation command basis, and (4) significantly economized on labor used for water application and on recurring investments to pump water from the well to the pond and then to the field. (Tickes-Arizona)
W79-10079

4. WATER QUANTITY MANAGEMENT AND CONTROL

4A. Control Of Water On The Surface

DEVELOPMENT OF AN EXTENSION OF ILLUDAS MODEL FOR CONTINUOUS SIMULATION OF URBAN RUNOFF QUANTITY AND DISCRETE SIMULATION OF RUNOFF QUALITY.
Purdue Univ., Lafayette, IN. Water Resources Research Center.
For primary bibliographic entry see Field 2A.
W79-09832

ENVIRONMENTAL EFFECTS OF COMPLEX RIVER DEVELOPMENT,
Westview Special Studies in Natural Resources and Energy Management, Westview Press, Boulder, Colorado, 1977. 172 p, 27 fig, 11 tab. G. F. White, ed.

Descriptors: *Water resources, *River basin development, *Environmental effects, *Water supply, *Developing countries, Water quality, Runoff, Water demand, Ecosystems, Climate, Alternative planning, Long-term planning, Trends, Water management(Applied), Feasibility.

To solve the pressing current problems of a limited water supply, we must always act with a global view to the future. Recognizing this, an international group of scholars--from the Soviet Union, Canada, Africa, and the United States--has met to review their experiences and research on the environmental effects of a number of large scale river management programs. This edited collection of their reports provides a balanced view of a vital element in the total ecosystem. Their analysis points out the urgent need to consider long-term trends in climate, to account for all feasible management alternatives, and especially to manage demand (as opposed to simply increasing water supply) and to defer irreversible action until all environmental impacts are estimated. The eight articles contained herein consider: (1) the comparative analysis of complex river development; (2) the Volga River; (3) the water economy and ecological problems of the Azov Sea; (4) transferring runoff from Northern and Siberian Rivers to the arid regions of the European USSR, Soviet Central Asia, and Kazakhstan; (5) the Columbia River; (6) changing approaches to managing water in the Fraser River Basin; (7) the Plate River Basin; and (8) observations from Kenya. (Bell-Graf--Cornell)
W79-09848

CAN OFF-PEAK PUMPING CUT UTILITY POWER COSTS,
Montgomery (James M.), Inc., Pasadena, CA.
J-L. Chao.

Journal of the American Water Works Association, Vol. 71, No. 5, p 259-263, May 1979. 10 fig, 4 ref.

Descriptors: *Pumping, *Water distribution(Applied), *Electric power, *Costs, Reservoir storage, Pumping plants, Water demand, Energy, Feasibility, Economics, Hydraulics, Pipelines, Equations, Operations research, Demand curve, Hazen-Williams equation, Off-peak pumping.

Rising energy costs and environmental concerns necessitate a reevaluation of conventional utility operations; utilities have proposed various methods of load management to meet increased demands. Electrical utilities are considering various options for load management by rate design. Clearly, time-of-use rates could significantly affect water utilities that require electric power for pumping their supplies. Examined herein is the feasibility of off-peak pumping in existing water distribution systems and the economics of various pumping and storage patterns under time-of-use power rates. The principal factors for study are: the available reserve pumping and reservoir capacities; the relative magnitude of system friction loss compared to static lift; and the interrelationship of these parameters with the system daily demand pattern. It is concluded that characteristics of individual distribution systems differ, and so the feasibility of adopting off-peak pumping should be investigated on a case-by-case basis. It is probable that few existing water distribution systems have the reserve pumping, transmission main, and reservoir storage capacities needed to pump only at off-peak hours; secondary pumping at a lower rate during peak hours may be required to compensate for these deficiencies. (Bell-Graf--Cornell)
W79-09860

COMPUTER APPLICATIONS: A TOOL FOR WATER DISTRIBUTION ENGINEERING,
Gilbert/Commonwealth, Reading, PA.
J. L. Caves, and T. C. Earl.
Journal of the American Water Works Association, Vol. 71, No. 5, p 230-235, May 1978. 9 fig, 7 ref.

Descriptors: *Water distribution(Applied), *Computers, *Technology, *Engineering, Data storage and retrieval, Hydraulics, Steady state, Design, Simulation analysis, Water storage, Pumping, Hydraulic surge, Control, Planning, Maintenance, Networks, Cost effective.

Improvements in digital computer hardware have coincided with important advances in the use of computers to solve complex problems. Considerable benefit can be realized from recent advances in computer applications technology in the field of water distribution engineering. Discussed are the areas of distribution system data, hydraulic analysis (steady state) and design, storage simulation, hydraulic surge, control systems, maintenance, planning, and implementing computer applications. Provided is an overview of techniques relating technological advances to conditions that commonly exist in water distribution. The application of computer capabilities to the technical functions of water distribution will become increasingly important as both the costs of distribution and public pressure to reduce these costs escalate. The advanced computer techniques described herein offer water utilities tools for acquiring greater engineering insight and understanding of the complexities of their distribution systems. (Bell-Graf--Cornell)
W79-09875

DEVELOPING A COMPUTER PROGRAM FOR DISTRIBUTION SYSTEM ANALYSIS,
CH2M/Hill, Inc., Corvallis, OR.
A. L. Davis, and R. W. Jeppson.
Journal of the American Water Works Association, Vol. 71, No. 5, p 236-241, May 1978. 4 fig, 17 ref.

Descriptors: *Water distribution(Applied), *Computer programs, *Systems analysis, *Networks, Reservoirs, Pumps, Pipes, Simulation analysis, Evaluation, System performance, Equations.

Computer analysis tools have been developed for evaluating the performance of both current and proposed systems at moderate cost. These tools include time-saving input and output devices, formats, and an analysis program that simulates all appurtenances commonly encountered in a water distribution system. Considered herein are general principles of network analysis in which a system of simultaneous equations is solved; considered are the Newton method, the Hardy Cross method, the Darcy-Weisbach equation, and the Hazen-Williams equation. Discussed are: requirements for computer analysis of networks, including effective man-machine interface and systems analysis; and program development, performance, and applications. Using the computer tools discussed herein. both steady-state and time-dependent simulations can be performed. (Bell-Graf--Cornell)
W79-09876

MODELING WATER DISTRIBUTION IN SANTA CLARA COUNTY, CALIF.,
National Inst. for Water Research, Pretoria (South Africa).
G. C. Hall, and L. Ortolano.
Journal of the American Water Works Association, Vol. 71, No. 5, p 242-247, May 1978. 3 fig, 8 ref.

Descriptors: *Water distribution(Applied), *Simulation analysis, *Optimization, *Cost minimization, *Water delivery, *Scheduling, Computers, Planning, Monthly, Linear programming, Equations, Decision making, Groundwater basins, Constraints, Santa Clara County(CA), Mathematical models, Systems analysis.

In planning for the allocation of water supplies, the Santa Clara Valley Water district must decide on monthly delivery schedules for the annual entitlements of imported water; the district must also decide how to distribute these imported supplies and the precipitation in local basins among various water treatment plants and groundwater recharge basins. The district relies on a simulation model to determine distribution schedules, but this model does not account systematically for economic factors such as the cost of water transmission between various points in the distribution system. Research at Stanford University has derived an improved modeling procedure utilizing the district's simulation model in tandem with a linear programming (LP) optimization model. This article discusses: the nature of the district's distribution problem; the district's simulation model, including model inputs and outputs and model usage; the linear programming model, the objective function of cost minimization, and the problem constraints; and the tandem use of the LP and simulation models for computerized planning of monthly distribution schedules, which provides technically feasible and economical results. (Bell-Graf--Cornell)
W79-09877

SUBSIDENCE RELATED TO LAND USE IN EVERGLADES AGRICULTURAL AREA,
Agricultural Research and Education Center, Belle Glade, FL.
S. F. Shih, J. W. Mishoe, J. W. Jones, and D. L. Myhre.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 3, p 560-563 and 568, May-June 1979. 2 fig, 4 tab, 6 ref.

Descriptors: *Subsidence, *Land subsidence, *Land use, *Agriculture, *Florida, Soils, Organic soils, Surveys, On-site investigations, Regression analysis, Statistics, Statistical analysis, Crops, Pasture, Field crops, Vegetable crops, Farm practices, Drainage, *Everglades agricultural area.

Historical data obtained from the organic soil subsidence lines established in the Everglades Agricultural Area were examined statistically to relate subsidence rates to differences in land use conditions and locations. The rate of subsidence varied from 1.5 to 3.1 cm/yr. Subsidence rates varied depending on land use. Based on the conventional water control systems of the past 35 years, the order of subsidence rates for different land uses was field crops, truck crops, sugarcane, virgin grass, pasture. (Sims-ISWS)
W79-09968

FLOOD PLAIN INFORMATION: POJOAQUE RIVER AND TRIBUTARIES, SANTA FE COUNTY, NEW MEXICO,
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W79-10012

FLOOD PLAIN INFORMATION: MIMBRES RIVER AND FLORIDA GAP DRAW, DEMING, LUNA COUNTY, NM.
Army Engineer District, Albuquerque, NM.
For primary bibliographic entry see Field 2E.
W79-10013

FLOOD HAZARD ANALYSES, WORTHLEY BROOK, TOWN OF POLAND, MAINE, ANDROSCOGGIN COUNTY,
Soil Conservation Service, Orono, ME.
For primary bibliographic entry see Field 2E.
W79-10014

4B. Groundwater Management

LAGOON RECHARGE OF THE FOLKESTONE BEDS AT HARDHAM, SUSSEX--1972-75,
Southern Water Authority, Eastleigh (England). Directorate of Resource Planning.
D. Izatt, G. B. Fox, and M. Tague.
Journal of the Institution of Water Engineers and Scientists, Vol. 33, No. 3, p 217-236, May 1979. 8 fig, 4 tab, 8 ref.

Descriptors: *Artificial recharge, *On-site investigations, *Aquifers, *Pit recharge, Lagoons, Recharge ponds, Methodology, Foreign research, On-site tests, Groundwater recharge, On-site data collections, Infiltration rates, Water quality, Deposition(Sediments), Head loss, Pore pressure, Rivers, *England, *Folkestone beds(England), Bed clogging, Recharge rates.

The paper summarized experiments carried out at an experimental lagoon site at Hardham Church Farm, 1 km south of Pulborough, Sussex during the period August 1972 to March 1975. The experiments involved artificial recharge of the Folkestone Beds aquifer with raw river Arun water. The objectives were: (1) to determine the extent of the Folkestone Beds aquifer, its coefficients of transmissivity and storage, its storage capacity, and its maximum yield; (2) to determine the sedimentation rate and changes in sediment load of the raw river water at various tidal and seasonal periods; (3) to ascertain the recharge rates which could be achieved utilizing both treated and untreated river water, the suspended solids/biological/chemical clogging effects, the effects of head variation and filter media on clogging, and the most effective recharge pattern; (4) to determine the chemical changes taking place in the recharge water on its passage through the aquifer, and the resulting water quality; and (5) to assess the development costs of recharge, abstraction, and treatment. Average lagoon recharge rates ranged from 2.1 m/day to 0.8 m/day per unit bed area, reflecting the complexity of lagoon recharge behavior and characteristics experienced. The cycles lasted up to 110 days, depending on the clogging of the lagoon beds. The main clogging agent was suspended solids present in the river water (coarse to medium silt), although algal growth in the lagoons made a significant contribution. Chemical clogging was insignificant. Severe clogging was limited to the top few centimeters of the beds, although some sediment penetrated to at least 15 to 20 cm. Other factors influencing lagoon recharge behavior were temperature of the recharge water, growth of the recharge mound, mutual interference between the lagoons, and bed-cleaning activities. Few changes in the hydrochemistry of the recharged water occurred, namely, a slight reduction in pH, total hardness, alkalinity and calcium, and a marked reduction in dissolved iron and manganese. The lagoon beds were cleaned by manual scraping, drag-line, wheeled shovel loader, and tracked shovel loader. Operating costs for 1973-74 and

1974-75 were 1.37 pence/cu m and 1.97 pence/cu m. (Humphreys-ISWS)
W79-09988

FERTILIZER NITROGEN DISTRIBUTION UNDER IRRIGATION BETWEEN SOIL, PLANT, AND AQUIFER,
Minnesota Univ., St. Paul.
J. R. Gerwing, A. C. Caldwell, and L. L. Goodroad.
Journal of Environmental Quality, Vol. 8, No. 3, p 281-284, July-September, 1979. 3 fig, 2 tab, 20 ref. OWRT A-034-MINN(1).

Descriptors: *Nitrogen fertilizers, Irrigation water, *Groundwater, Leaching.

A field experiment was established on a Sverdrup sandy loam in Central Minnesota to evaluate the effects of amounts and timing of nitrogen (N) fertilizer applications on N uptake by irrigated corn (Zea mays L.) and the movement of N into the aquifer 4.5 m below the soil surface. Nitrogen was applied as urea at rates of 179 and 269 kg N/ha in one application at planting or in split applications through the season. Soil solution analysis showed NO3 moving below the rooting zone in all plots with much higher concentrations below the one-time fertilizer applications. Split applications of N had only minimal effect on the concentration of NO3-N in the aquifer but one-time applications increased the concentration by 7 and 10 ppm. The use of 15N showed that splitting the 179-kg rate increased the N in the plant derived from fertilizer from 33.1 to 54.5%, and increased the recovery of fertilizer N by the plant from 30.4 to 52.1%, even though whole plant yields were not affected. Nearly one-fourth of the applied N remained in the upper 45-cm soil layer at harvest regardless of treatment. No accumulation of NO3 was found in the soil profile or underlying material to a depth of 3.0m. (Blake-Minn)
W79-10024

4C. Effects On Water Of Man's Non-Water Activities

CAN FOREST LAND PRODUCE WOOD, RECREATION, AND HIGH QUALITY WATER TOO,
Northeastern Forest Experiment Station, Parsons, WV.
J. H. Patric.
The Northern Logger and Timber Processor, Vol. 27, No. 12, p 6-7, 36-37. 1979.

Descriptors: *Demonstration watersheds, *Forestry, Sediment yield, Specific conductance, Land use, Logging, Roads, West Virginia.

The watershed of Elk Lick Run, a 1,400-acre portion of the Fernow Experimental Forest, supplies water to Parsons, West Virginia. Land use in this area since 1900 is reviewed. Scientists, loggers, and recreationists use the area heavily, perhaps as heavily as any municipal watershed in eastern United States. The effects on chemical and physical properties of water are minimal. Restricted use of the watershed would have cost the public far more, in terms of foregone wood and jobs, than the public would have gained in benefits to water resources. (Forest Service)
W79-09851

DRAINAGE PRACTICE IN IMPERIAL VALLEY,
Science and Education Administration, Brawley, CA. Imperial Valley Conservation Research Center.
For primary bibliographic entry see Field 3C.
W79-09910

4D. Watershed Protection

SOME EFFECTS OF UREA FERTILIZATION ON A FORESTED WATERSHED IN WEST VIRGINIA,
Northeastern Forest Experiment Station, Parsons, WV.
For primary bibliographic entry see Field 2K.
W79-09847

5. WATER QUALITY MANAGEMENT AND PROTECTION

5A. Identification Of Pollutants

THE CHEMICAL COMPOSITION OF THE UPPER HENNOPS RIVER AND ITS IMPLICATIONS ON THE WATER QUALITY OF RIETVLEI DAM,
National Inst. for Water Research, Pretoria (South Africa).
D. F. Toerien, and R. D. Walmsley.
Water S.A., Vol. 5, No. 2, p 77-89, April 1979. 6 fig, 6 tab, 18 ref.

Descriptors: *Water quality, *Water chemistry, *Eutrophication, Algal blooms, Oxygen requirements, Sewage effluents, Marshes, Sodium, Potassium, Calcium, Magnesium, Alkalinity, Nitrogen, Reservoirs, Hennops River, Rietvlei Dam.

A chemical investigation of the upper Hennops River was conducted between 1973 and 1975. Rietvlei Dam, situated on the Hennops River, has been a source of water supply to the city of Pretoria since 1933. Secondary treated sewage effluents from Kempton Park are discharged into the upper Hennops River approximately 25 km upstream from Rietvlei Dam. Up to 73% of all the annual inflow into Rietvlei Dam consists of discharged sewage effluents. The Hennops River is joined above the dam by smaller non-perennial tributaries. The river rises in a marshy area (vlei), passes through a swamp before receiving the Kempton Park discharge, and then passes through two more vlei before the dam catchment area. Nine sampling stations were selected at intervals along the course of the river to estimate the change in composition of the water with distance from the sewage plant. Automated techniques were used for analysis of sodium, potassium, calcium, magnesium, chloride, sulphate, conductivity, ammonia, nitrate, nitrite, Kjeldahl nitrogen, orthophosphate, total dissolved phosphate, silica, alkalinity, and chemical oxygen demand. Results show that water quality just above the dam is good. Rietvlei Dam is highly eutrophic as far as phosphorus is concerned. Evidence suggests that vlei systems may be important in removing both available nitrogen and phosphorus from the river, and the establishment of artificial vlei systems should be considered. (Seigler-IPA)
W79-09843

UNCERTAINTY ANALYSIS APPLIED TO VOLLENWEIDER'S PHOSPHORUS LOADING CRITERION,
Michigan State Univ., East Lansing.
K. H. Reckhow.
Journal of the Water Pollution Control Federation, Vol. 51, No. 8, p 2123-28, August 1979. 5 fig, 2 tab, 7 ref.

Descriptors: *Water quality, *Statistical methods, *Lakes, *Phosphorus, *Loading, *Vollenweider criterion axes, *Trophic states, *Uncertainty analysis, Mathematical models, Equations, Systems analysis, Sediments, Regression analysis, Estimating, Prediction, Probability.

Vollenweider's phosphorus loading criterion, like most mathematical models and graphical loading criteria, suffers because uncertainty is ignored. Uncertainty is present in the application of a loading criterion to estimate trophic state inasmuch as the criterion is subject to professional disagreement and estimation error and inasmuch as the input variables, particularly phosphorus loading, are not known with certainty. A graphical procedure is proposed here that assigns confidence limits, reflecting estimation error, to the trophic state transition lines on Vollenweider's criterion axes. Additional graphs that can be used to combine the loading criterion error with the loading uncertainty for a particular lake are then presented. These graphs provide an estimate of the likelihood that a lake will become oligotrophic, mesotrophic, or eutrophic. (Bell-Graf--Cornell)
W79-09856

WATER QUALITY SAMPLING PROGRAMS IN RIVERS,
Melbourne Univ., Parkville (Australia). Centre for Environmental Studies.
G. C. Dandy, and S. F. Moore.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers, Vol. 105, No. EE4, p 695-711, August 1979. 6 fig, 1 tab, 24 ref.

Descriptors: *Water quality, *Sampling, *Rivers, *Programs, *Stochastic processes, *Methodology, *Water analysis, *Design, Model studies, Systems analysis, Equations, Decision making, Dissolved oxygen, Biochemical oxygen demand, Streamflow, Simulation analysis, Monitoring, Probability, Dynamic programming, Optimization, Algorithms, Standards, Cost-effective, Shenango-Beaver River(PA), Cost minimization, Long-term trends.

A central decision in the collection of water quality data from a river is the choice of the locations and frequencies of sampling. This paper proposes a methodology for the selection of these design variables, for given water quality constituents, based on the use of a stochastic model of the river. The design method is demonstrated for the coupled constituents of BOD and DO in the Shenango-Beaver River, Pennsylvania. Cost-effective sampling designs are identified, using a dynamic programming algorithm, for two principal objectives: (1) detection of violations of in-stream water quality standards; and (2) assessment of the present state of water quality in the river. The objective function is cost minimization. Results indicate that efficient designs for the abatement function tend to emphasize intensive sampling at a few critical locations. Efficient designs for the prevention function, however, emphasize sampling effort distributed spatially over the river network. (Bell-Graf--Cornell)
W79-09859

A COMPARATIVE CASE STUDY OF DYNAMIC MODELS FOR DO-BOD-ALGAE INTERACTION IN A FRESHWATER RIVER,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
M. B. Beck.
Publications No. RR-78-19, December 1978. 66 p, 9 fig, 15 tab, 51 ref, 2 append.

Descriptors: *Comparison, *Simulation analysis, *Biochemical oxygen demand, *Dissolved oxygen, *Freshwater, *Rivers, *Model studies, *Water quality, *Field data, Equations, Systems analysis, Dynamic models, Black box model, Model development, Response error statistics, Assessment, Cam River system(Great Britain).

There is a need for comparative studies of different model types against the same set of field data. Although models can be readily applied in management and decision making, they are not always so readily subject to a prior verification against field data from the river system. The primary goal of this paper is the dissemination of a set of time-series field data suitable for the identification and verification of dynamic models for water quality. Here water quality is interpreted as the interaction between three variables: dissolved oxygen concentration; biochemical oxygen demand concentration; and a population of algae. A secondary objective is the comparison, by means of response error statistics, of several models that have been derived by reference to the field data. A third objective is to present a summarizing and concluding statement

on river water quality model development exercise which spans various publications over the past few years. In terms of model comparison and assessment, the paper concludes with a cautionary message on the use of simple fitting error statistics; it is argued that judgments about the 'best' model are dependent upon the intended application of the model. On the accuracy of the models as representations of the real system, it is found that many questions are unresolved, particularly for those aspects related to the growth kinetics, death, and decay properties of floating algal populations. (Bell-Graf--Cornell)
W79-09862

ELEMENTS OF A WATER QUALITY INFORMATION SYSTEM FOR THE STATE OF ILLINOIS,
Northern Illinois Univ., DeKalb. Dept. of Geology.
R. C. Flemal, D. C. Wilkin, and B. B. Ewing.
Water Resources Bulletin, Vol. 15, No. 4, p 996-1003, August 1979. 6 tab, 7 ref.

Descriptors: *Water quality, *Information system, *Illinois, Planning, Environmental quality, Streams, Monitoring, Decision making, Standards, Performance, Seasonal, Time-trend analysis, Effects, Dissolved solids.

A large amount of information can be derived from the study of standard stream monitoring data, if these are properly ordered and organized. This information may then be used to make decisions concerning water quality management. Among critical information items are evaluation of performance to standards, determination of seasonality and time-trends of water quality conditions, and estimation of the effects on water quality to be expected from load reductions or standards modifications. Additional information on the magnitude of individual pollution sources is also critical to water quality management. Each of these items can be derived within the water quality information system which is currently under development for the State of Illinois. (Bell-Graf--Cornell)
W79-09869

CONSEQUENCES OF HARVESTING AND SITE PREPARATION IN THE PIEDMONT,
Georgia Univ., Athens. School of Forest Resources.
W. L. Nutter, and J. E. Douglass.
In: Proceedings: A symposium on principles of maintaining productivity on prepared sites, March 21-22, 1978, Mississippi State University, p 65-72, 1978. USDA Forest Service, Southern Forest Experiment Station and Southeast Area State and Private Forestry, New Orleans, Louisiana, 22 ref.

Descriptors: *Erosion, *Water quality, *Suspended sediments, *Erosion control, *Forest practices, Piedmont soils.

Piedmont soils suffered years of abuse under agriculture. Now stabilized under forest, these sites are subject to change by harvesting and site preparation. Increased erosion and lowered water quality may occur as a result. These changes can be controlled if the manager specifies conservation practices and the amount of mineral soil that can be exposed during harvest and regeneration. Methods of site preparation applied in the Piedmont need to be reexamined in light of specific silvicultural objectives and disturbance created by various methods. (Forest Service)
W79-09878

FLUCTUATIONS IN NATURALLY OCCURRING POPULATIONS OF ENTERIC BACTERIA IN OLIGOTROPHIC STREAMS OF WESTERN NORTH CAROLINA,
Georgia Univ., Athens.
M. R. McSwain, and W. T. Swank.
USDA Forest Service Research Paper SE-158, February 1977. 12 p, 4 fig, 3 tab.

Descriptors: *Heterotrophy, *Stream discharge, *Turbidity, *Coliform bacteria, *Streptococcus bacteria, Diurnal cycles, Stream nutrient content, Southern Appalachian Mountains, North Carolina.

In mountain streams of western North Carolina, naturally occurring populations of enteric bacteria fluctuated seasonally and diurnally. Seasonal fluctuations in total coliforms and fecal coliforms were apparently regulated by water temperature. Diurnal fluctuations in total coliforms were inversely related to daily cycles in streamflow. Total and fecal coliforms and fecal streptococci peaked during stormflows. These fluctuations complicate the assessment of water quality and should be considered in designs for stream sampling. (Forest Service)
W79-09902

SOIL WATER CONTENT AND TEMPERATURE AS FACTORS IN THE VOLATILE LOSS OF APPLIED MERCURY (II) FROM SOILS,
Oregon State Univ., Corvallis.
For primary bibliographic entry see Field 2K.
W79-09916

ELECTROCHEMICAL DETERMINATION OF HEAVY METALS IN WATER AND APPARATUS THEREFOR,
Siemens A.G., Munich (Germany, F.R.). (Assignee).
W. Kellermann, H. Nischik, and F. V. Sturm.
U.S. Patent No. 4,146,436, 9 p, 3 fig, 6 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1403, March 27, 1979.

Descriptors: *Patents, *Monitoring, *Water pollution, Heavy metals, Electrochemistry, Chemical precipitation, Electrodes, Direct currents.

A method is described for electrochemically determining the concentration of heavy metals in water through precipitation of the metals at a solid electrode under the influence of a constant negative d-c voltage and subsequent dissolution of the metals by anodic oxidation. The process can be used for the automatic and unattended determination, recording and monitoring of heavy metals in water. This is achieved by: precipitating the metals at a metal electrode of the platinum family; after the precipitation of the metals, replacing the water by an electrolyte solution, dissolving the precipitated metals again by a sudden change of the negative d-c voltage into a constant positive d-c voltage, during which the electric charge required for the dissolution is determined and the concentration determined; and maintaining the application time and the magnitude of the d-c voltage always constant during the precipitation as well as during the dissolution of the metals. (Sinha-OEIS)
W79-09935

A SIMPLIFIED METHOD FOR THE SIMULATANEOUS EXTRACTION OF PHYTOPLANKTONIC CHLOROPHYLL AND FECAL STEROL FROM WATER,
Massachusetts Univ., Waltham. Dept. of Environmental Sciences.
C. K. Wun, J. Rho, R. W. Walker, and W. Litsky.
Water, Air, and Soil Pollution, Vol. 11, No. 2, p 173-178, February 1979. 3 tab, 10 ref.

Descriptors: *Analytical techniques, *Chlorophyll, *Sewage, *Water quality, Solvent extractions, Laboratory tests, Resins, Plankton, Phytoplankton, Water pollution, Pollutants, Pollutant identification, Algae, Aqueous solutions, Chemicals, Chemical analysis, Coprostanol, Fecal sterol.

A simple column method employing Amberlite XAD-I (60-120 mesh) resin for the simultaneous extraction of coprostanol and algal chlorophyll a was proposed and evaluated. The results showed that the efficiencies of the column extraction for these two water quality indicators were comparable to or better than the conventional hexane liquid/liquid partitioning and aqueous acetone extraction for the respective compounds. Furthermore, the column technique was time-saving and more economical. (Sims-ISWS)
W79-09979

CHLOROPHENOLS IN SURFACE WATERS OF THE NETHERLANDS (1976-1977),
Rijksinstituut voor de Volksgezond-heid, Bilthoven (Netherlands).
R. C. C. Wegman, and A. W. M. Hofstee.
Water Research, Vol. 13, No. 7, p 651-657, 1979. 6 fig, 6 tab, 12 ref.

Descriptors: *Water pollution, *Phenols, *Pesticides, *Laboratory tests, Analytical techniques, Chlorinated hydrocarbon pesticides, Gas chromatography, Chromatography, Rivers, Methodology, Testing procedures, Data collections, *The Netherlands, *Rhine River, *Meuse River, Chlorophenols, Monochlorophenols, Dichlorophenols, Trichlorophenols, Tetrachlorophenols, Pentachlorophenols.

An analytical method was described for the capillary gas chromatographic determination, after derivatization, of 19 individual chlorophenols in surface water. The minimum detectable amounts are for monochlorophenols 2 microgram/l, for dichlorophenols 0.05 microgram/l, for trichlorophenols 0.02 microgram/l, and for tetra- and pentachlorophenols 0.01 microgram/l. The results of a monitoring program in the river Rhine and other Dutch surface waters with respect to these compounds were presented. The results covered the period January 1976-December 1977. 2,6-Dichlorophenol, 2,4,6-trichlorophenol, 2,3,4,6-tetrachlorophenol and pentachlorophenol had the highest frequencies of occurrence in the river Rhine and its tributaries. Pentachlorophenol was found in the highest concentrations (up to 11 microgram/l). (Humphreys-ISWS)
W79-09987

PROCEEDINGS OF A WORKSHOP ON SCIENTIFIC PROBLEMS RELATING TO OCEAN POLLUTION, ESTES PARK, COLORADO, JULY 10-14, 1978,
National Oceanic and Atmospheric Administration, Environmental Research Laboratories, Boulder, CO. March 1979. 228 p.

Descriptors: *Water pollution, *Pollutant identification, *Water pollution sources, *Water pollution effects, Chlorination, Dredging, Microorganisms, Metals, Fossil fuels, Litter, Conferences, *Outer Continental Shelf, Artificial radionuclides, Biological effects, Biostimulants, Synthetic organics.

The purpose of a workshop held in Estes Park Colorado on July 10-14, 1978, was to write a strong, comprehensive statement of the scientific problems of ocean pollution and identify research, development, and monitoring programs that should be undertaken in order to solve these problems. Following the review and overview of 'Ocean Pollution Research, Development, and Monitoring Needs' presented by E. D. Goldberg, the following workshop subjects are presented: Synthetic Organics, Chlorination Products, Dredging and Disposal of its Large-Volume Waste, Litter, Artificial Radionuclides, Microorganisms, Trace Metals, Biostimulants, Fossil Fuel Compounds, and Biological Effects - A Generic View. (See also W79-10050 thru W79-10059) (Sinha-OEIS)
W79-10049

NITRATE LEVELS IN GROUNDWATER FROM THE FLEUVE, SENEGAL,
Yale Univ., New Haven, CT. Dept. of Epidemiology and Public Health.
M. Berwick.
Progress in Water Technology, Vol. 11, No. 1, p 117-120, 1978. 1 tab, 20 ref.

Descriptors: *Water quality, *Animal diseases, *Human diseases, *Chemical analysis, *Public health, *Environmental effects, *Regional analysis, Nitrates, Arid lands, Environmental sanitation, Water pollution effects, Water quality control, Groundwater, Water resources development, Qualitative analysis, Senegal River Basin.

Nitrate concentrations of drinking water in arid regions of Africa, where they are likely to rise with the development of irrigation in the Senegal River Basin, have been found to be related to a number of diseases in infants and ruminants. Rec-

ognizing this relationship, the present study was carried out to determine the nitrate concentration of water samples collected from a number of sources within a 100 km radius of St. Louis, Senegal. Using the Brucine colormetric analysis, nitrate ion concentrations were found in some cases to be well in excess of acceptable levels. The risks of these high levels to infants and ruminants in Fleuve, Senegal are discussed with the suggestion that the problem deserves immediate attention. (Tickes-Arizona)
W79-10067

5B. Sources Of Pollution

A STUDY OF THE REUSE OF REUSED WATER,
Construction Engineering Research Lab. (Army), Champaign, IL.
For primary bibliographic entry see Field 3C.
W79-09846

USE OF BAKER'S YEAST TO TRACE MICROBIAL MOVEMENTS IN GROUND WATER,
Geological Survey, Reston, VA.
W. W. Wood, and G. G. Ehrlich.
Ground Water, Vol. 16, No. 6, p 398-403, November-December 1978. 6 fig, 9 ref.

Descriptors: *Yeasts, *Groundwater, *Microbial movement, *Tracers, *Water quality control, Contaminants, Experiments, Flow, Aquifers, Pumping, Wells, Pathogens, Pore volume, Sodium bromide, Calcium carbonate, Lithology, Stanton(TX).

Field and laboratory experiments were made using suspensions of baker's yeast (Saccharomyces cerevisiae) to trace the movement of microbes in artificially recharged groundwater. Yeast cells penetrated more than 7 meters into a sand and gravel aquifer in less than 48 hours. It is believed that most of the cells travelled through channels formed by the solution of calcium carbonate rather than through intergranular pores. Ease and sensitivity of detection, low cost, and negligible background correction suggest that baker's yeast is an excellent choice as a tracer for this type of application. (Bell-Graf--Cornell)
W79-09855

LOW PICLORAM CONCENTRATIONS IN STREAMFLOW RESULTING FROM FOREST APPLICATION OF TORDON-10K,
Southeastern Forest Experiment Station, Franklin, NC. Coweeta Hydrologic Lab.
D. G. Neary, J. E. Douglass, and W. Fox.
In: Proceedings of the Southern Weed Science Society, January 23-25, 1979, Atlanta, Georgia, p 77-89, 1979. Auburn University Printing Service, Auburn, Alabama. 4 fig, 3 tab, 25 ref.

Descriptors: *Herbicides, *Pesticide residues, *Watershed management, *Water quality, Soil, Nutrients, Streamflow, Forest management, *Picloram, *Tordon-10K, Southern Appalachian Mountains.

Tordon-10K (Trade name) pellets were applied to 4 ha of a watershed at the Coweeta Hydrologic Laboratory, Franklin, N. C., to prepare a low-quality hardwood stand for planting eastern white pine (Pinus strobus L.). The herbicide was applied in May 1978 at a rate of 50 kg/ha (5 kg/ha a.i. picloram). Although application was followed by dry weather conditions, 76 percent of the overstory plants and 95 percent of the rhododendron (Rhododendron spp.) and laurel (Kalmia latifolia L.) in the understory were initially affected. Probably because of drought, only 30 percent of the overstory and 20 percent of the understory plants were killed. During the first 5 months after application, soil solution at 30 cm contained less than 10 ppb picloram until heavy rains in August; then, a peak of 174 ppb was measured. At 60 cm, picloram peaked 2 months later at 179 ppb. In the soil solution sampled at 120 cm, picloram concentrations never exceeded 3 ppb. Picloram was only detected twice (late June and early July) in streamflow, and the maximum concentration was only 8 ppb. After heavy rains in August totalling nearly 290 mm, no picloram was detected in streamflow. No major leaching of anions or cations has been evident in soil solution or streamflow. Based on this early data obtained during an intermittently dry summer, it can be concluded that well-controlled applications of Tordon-10K to ridges and upper slopes should not produce any significant pollution of streams draining the deep soil systems of the southern Appalachians. (Forest Service)
W79-09864

COMPARISON OF MEMBRANE FILTERS IN RECOVERY OF NATURALLY INJURED COLIFORMS,
Montana State Univ., Bozeman. Dept. of Microbiology.
For primary bibliographic entry see Field 7B.
W79-09890

FLUCTUATIONS IN NATURALLY OCCURRING POPULATIONS OF ENTERIC BACTERIA IN OLIGOTROPHIC STREAMS OF WESTERN NORTH CAROLINA,
Georgia Univ., Athens.
For primary bibliographic entry see Field 5A.
W79-09902

ALKANES IN SEAWATER IN THE VICINITY OF THE BUCCANEER OILFIELD,
Houston Univ., TX. Dept. of Biophysical Sciences.
B. S. Middleditch, B. Basile, and E. S. Chang.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, No. 3, p 413-420, 1979. 1 fig, 1 tab, 8 ref. NOAA 03-6-042-35120.

Descriptors: *Water pollution, *Oil fields, Gulf of Mexico, Pollutants, Organic compounds, Seawater, Hypolimnion.

Concentrations of alkanes in 76 water samples collected within 30 km of the Buccaneer oilfield were found to be as high as 43 ppb. It appeared that petroleum alkanes discharged from the production platforms float at the air/sea interface and are dispersed. Discharge from the production platforms of hydrocarbon-producing bacteria, or a nutrient which supports such bacteria, appeared to be responsible for the presence of bacterial hydrocarbons in bottom water samples down-current of the oilfield. (Chilton-ORNL)
W79-09905

PATHWAYS FOR MERCURY UPTAKE BY FISH FROM BED SEDIMENTS,
National Research Council of Canada, Ottawa (Ontario). Div. of Biological Sciences.
A. Kudo, and D. C. Mortimer.
Environmental Pollution, Vol. 19, No. 3, p 239-245, July 1979. 3 fig, 1 tab, 8 ref.

Descriptors: *Water pollution, *Water pollution sources, Path of pollutant, Sediments, Rivers, Fish, Absorption.

In these laboratory investigations, organic-rich sediments from the Ottawa River were treated with mercuric chloride to produce a total mercury concentration of 1.023 ppm in the sediments. Experimental results showed that mercury accumulation by fish in contact with sediment contaminated by mercury was much higher than that accumulated from the overlying water. (Chilton-ORNL)
W79-09918

INPUTS AND OUTPUTS OF WATER AND PHOSPHORUS FROM FOUR VICTORIA CATCHMENTS,
Monash Univ., Clayton (Australia). Dept. of Zoology.
I. C. Campbell.
Australian Journal of Marine and Freshwater Research, Vol. 29, No. 5, p 577-584, October 1978. 2 fig, 2 tab, 16 ref.

Descriptors: *River basins, *Phosphorus, *Streams, *Nutrient budgets, *Water balance, *Land use, *Watersheds(Basins), Victoria(Australia), Australia, Nutrients, Merri Creek(Australia), Little Yarra River(Australia), Cement Creek(Australia), Gardiner's Creek(Australia), Yarra River(Australia), Forest watersheds, Agricultural watersheds, Runoff, Precipitation(Atmospheric), Urban runoff.

Input-output studies of water and phosphorus in watersheds of four tributaries of the Yarra River, Victoria, Australia (1973-74) showed phosphorus gains in all but the urban watershed, with gain or loss chiefly determined by land use, rainfall, and amount of runoff generated by rainfall. All watersheds are low relief (0-300 m altitude). The Merri Creek catchment (380 sq km) is primarily used as a pasture for sheep and cattle (300 sq km), but also contains 80 sq km of heavy and light industry and moderate-to-high population density. Gardiner's Creek catchment (100 sq km) is entirely within metropolitan Melbourne. The Little Yarra River catchment (140 sq km) is 65% forested and the rest in pasture. Cement Creek catchment (13 sq km) is entirely forested. Stream discharge as a percentage of rainfall volume is considerably smaller for the Merri Creek (1%) and Cement Creek (8%) catchments than for Gardiner's Creek (22%) and Little Yarra River (25%). Phosphorus inputs were highest to Little Yarra River (14.3 kg/sq km/yr), followed by Cement Creek (13.2 kg), Merri Creek (10.1 kg), and Gardiner's Creek (9.2 kg). The greatest phosphorus output was from Gardiner's Creek (19.0 kg/sq km/yr), the only catchment in which phosphorus outflow exceeded input in precipitation, the excess attributed to detergents, sewage and drainage water, and industrial wastes. Phosphorus outflow is 8.3 kg from Little Yarra River, 2.4 kg from Cement Creek, and 1.6 kg from Merri Creek. Phosphorus levels increased markedly during high flow. (Lynch-Wisconsin)
W79-09921

NITROGEN-ISOTOPE RATIO STUDIES OF SOILS AND GROUNDWATER NITRATE FROM ALLUVIAL FAN AQUIFERS IN TEXAS,
Texas Univ. at Austin. Bureau of Economic Geology.
C. W. Kreitler.
Journal of Hydrology, Vol. 42, No. 1/2, p 147-170, June 1979. 10 fig, 6 tab, 39 ref. NSF DES74-13560.

Descriptors: *Nitrogen, *Isotopes(Stable), *Nitrates, *Groundwater, *Texas, Fertilizers, Farm wastes, Alluvial fans, Aquifers, Sampling, Soil contamination, Water pollution, Denitrification, Ammonium salts, Ureas.

Average nitrate concentrations of 54 water samples from the Lockhart and Taylor alluvial carbonate gravel aquifers (central Texas) and of 37 groundwater samples from Seymour alluvial siliceous gravel aquifer are 75 and 138 mg/l, respectively. The dominant nitrate sources over the aquifers are cultivated land with ammonium-type fertilizer and animal wastes from livestock and domestic waste. The delta 15N of fertilizer nitrogen used on the Lockhart and Taylor fans ranges from -7.4 to +1.9 parts per thousand. The delta 15N range of 20 soil nitrate samples from 15 cultivated fields on the two alluvial fans is +2 to +14 parts per thousand with an average of +8.8 parts per thousand. This delta 15N range for ammonium-fertilized, cultivated fields is more positive than the delta 15N range of nonfertilized fields because of volatilization of ammonia depleted in 15N during and after fertilizer application, which leaves nitrate enriched in 15N. The delta 15N of groundwater nitrate from irrigation wells on the two fans range from +3.3 to +10.8 parts per thousand with an average of +7.3 parts per thousand. Groundwater from domestic wells on the two fans has higher nitrate concentrations and a more positive delta 15N range (+6.7 to +18.2 parts per thousand with an average of +11.1 parts per thousand) than wells located in the cultivated fields. Nitrate contamination of wells located in cultivated fields results primarily from cultivation with ammonium-type fertilizers, whereas animal wastes are contaminating domestic well waters. (Visocky-ISWS)
W79-09983

THE QUALITY OF RUN-OFF FROM AN IRRIGATED MARKET GARDEN AREA IN BRAZIL,

Balfour (D.) and Sons, London (England).
R. M. Bradley, and D. Cabral, Jr.
Water Research, Vol. 13, No. 7, p 589-598, 1979. 2 fig, 8 tab, 19 ref.

Descriptors: *Water quality, *Agricultural runoff, *Water pollution sources, *Water pollution, Runoff, Irrigation water, Nitrogen, Fertilizers, Nutrients, Phosphorus, Potassium, On-site investigations, Data collections, Foreign research, Vegetable crops, Soil, Drainage water, Rain water, Metals, Copper, Zinc, Manganese, Insecticides, Dieldrin, Endrin, DDT, *Brazil, Endosulphan.

This paper presented the results of a study carried out in Brazil to determine the effects of irrigation and fertilizer use on the quality characteristics of runoff from an agricultural area used for intensive cultivation of market garden produce. The results showed that during dry weather the discharge of nutrients from the cultivated area when irrigation is taking place is equivalent to 7 kg/ha/yr N and 1 kg/ha/yr P. Considerable accumulation of nutrients took place in the soil during the growing season; over the 129-day survey period the nutrient content of the top soil increased by approximately 590 g/sq m N and P and 780 g/sq m K. This accumulation was derived from fertilizers which were applied at rates of 1136 kg/ha N, 978 P, and 1367 K. During wet weather, the nutrients which had accumulated in the soil were washed out. (Humphreys-ISWS)
W79-09985

CONCENTRATIONS OF NITRILOTRIACETATE AND CERTAIN METALS IN CANADIAN WASTEWATERS AND STREAMS: 1971-1975,
Procter and Gamble Co., Cincinnati, OH.
C. R. Woodiwiss, R. D. Walker, and F. A. Brownridge.
Water Research, Vol. 13, No. 7, p 599-612, 1979. 12 tab, 13 ref.

Descriptors: *Water pollution, *Canada, *Waste water(Pollution), *Nitrilotriacetic acid, Streams, Water pollution sources, Phosphorous, Detergents, On-site investigations, Sewage treatment, Data collections, Analysis, Methodology, Seasonal, Copper, Chromium, Cadmium, Lead, Zinc, Iron, Aluminum, Nickel, Sodium.

At 13 Ontario cities, representing a variety of populations and sewage treatment processes, grab samples were taken from the sewage treatment plant influent and effluent and from the receiving stream above and below the sewage outfall. The samples, taken once each month from November 1971 to March 1975, were analyzed for nitrilotriacetate (NTA), 9 metals, and phosphorus. From April 1971 to January 1973, household detergents in Canada contained an average of 6% NTA; after March 1973, they contained 15%. This increased usage of NTA was reflected in the NTA content of sewage influents, which rose from a median level of 1.3 mg/l before the change to 3.2 mg/l after the change. NTA levels in sewage effluent also increased somewhat, but much of the NTA disappeared in the sewage treatment processes. Even with the increased usage of NTA, the receiving streams below the sewage outfall contained only low levels of NTA: 97% of all samples during this period contained less than 0.5 mg/l, and the median concentration was 0.05 mg/l. Phosphorus concentrations in the sewages decreased at the time detergent compositions changed. Comparison of metal concentrations before and after the change, as well as metal-NTA correlation coefficients, failed to show clear evidence of an association between NTA concentration and metal concentration. (Humphreys-ISWS)
W79-09986

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS MANAGEMENT AREA, EMMA STUDY, VOLUME 3B: STUDY OF WASTES FROM LARGE INDUSTRIES,
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 796, Price codes: A13 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 55 p, 11 fig, 9 tab, 10 app. See also Summary Report and other Technical Data Volumes.

Descriptors: *Massachusetts, Waste water treatment, *Industrial wastes, *Data collections, *Water quality, *Waste water management, *Waste loads, Industrial plants, Industrial water, Chemical industry, Food processing industry, Mineral industry, Pulp and paper industry, Textiles, Data processing, Data storage and retrieval, Data transmission, Waste identification, Boston(MA).

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. The purpose of this portion of the study is to collect and interpret existing information on the quantity and quality of large industrial area manufacturing process wastewater discharges in the study area, and to project these discharges into the future. The data collected have been placed in a data retrieval and plotting system to be used as an effective planning tool. The industrial focus of this study is an outgrowth of earlier efforts to characterize industrial waste water in the area, which examined discharges from 27 industrial groups. This study investigates the larger industrial sites--those discharging 50,000 gallons of waste water per day; those whose water intake was low and where in excess of 250 persons were employed; and those with high intake employing in excess of 100 persons. These industrial lists are verified and the data form finalized. Data retrieval and plotting, verification, loading and selection are reviewed. The data are discussed and future waste load projections are made. All surveyed industries are listed and classified according to magnitude of discharge. Nine appendices list all industries surveyed, those discharging more than 50,000 gallons/day and those with zero discharge, and present detailed data for the industries surveyed. (See also W79-09992) (Zayac-NC)
W79-09995

WASTEWATER ENGINEERING AND MANAGEMENT STUDY FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 3A: STUDY OF CERTAIN INDUSTRIAL WASTES.
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 797, Price codes: A08 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 224 p, 11 fig, 9 tab, 10 append.

Descriptors: *Massachusetts, *Data collections, *Industrial wastes, *Waste water treatment, *Water pollution sources, *Water quality, *Waste water management, Data processing, Data storage and retrieval, Data transmission, Measurement, Monitoring, Statistics, Surveys, Chemical wastes, Pulp wastes, Food processing industry, Mineral industry, Textiles, Information retrieval, Information exchange, Boston(MA), Data plotting, Data verification.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. The purpose of this portion of the study is to collect existing information and to generate new information on the magnitude and composition of certain industrial and manufacturing process wastewater discharge in the study area. The scope of the study was to inventory 27 industrial groups in 109 communities. Current levels of industrial waste were projected to the years 1990, 2020 and 2050. A detailed description of the methodology used is presented. Industrial literature surveys were undertaken. Location surveys were undertaken to collect location and site-specific data on the industrial groups covered by the study. A computer data retrieval system and plotting routine were developed to allow efficient use of the data files developed by the location surveys. The data are presented and discussed by industry. Data manipulations indicate that the current level of industrial process water discharge in the study area is 31,000,000 gallons/day for the 27 industrial groups. Of this, 92% of the total (28,600,000 gallons/day) is discharged by the 71 largest dischargers, while 56% of the locations discharged no process water. Projections of future industrial waste loads in the area indicate that improvements in water use technology will offset expected growth in industrial production; process wastewater volume from surveyed industries is expected to remain constant until 1990, with a rise to about 48,000,000 gallons/day by 2050. Nine appendices list all industries surveyed, and present detailed data for the industries surveyed. (See also W79-09992) (Zayac-NC)
W79-09996

A LAND-USE PLANNING MODEL FOR COASTAL ZONE MANAGEMENT,
State Univ. of New York at Stony Brook. Coll. of Engineering and Applied Sciences.
For primary bibliographic entry see Field 6A.
W79-10015

LEVELS AND SOURCES OF CRITICAL TRACE METALS IN THE MARINE ENVIRONMENT,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
R. C. Clark, Jr.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 5-51, March 1979. 9 tab, 103 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO.

Descriptors: *Baseline studies, *Water pollution sources, *Metals, Resources development, Environmental effects, Copper, Chromium, Nickel, Cadmium, Lead, Mercury, Trace elements, *Outer Continental Shelf, Petroleum development.

Some of the elements in petroleum are also found in seawater where they range in concentration from a few percent to parts per trillion. The ecological aspects, or effects, of these elements may range from beneficial (essential) to detrimental (toxic). Any assessment of the biological effects of trace metals from petroleum on the marine environment must consider the levels of these elements in petroleum, drilling chemicals, and production (brine) waters; the levels naturally present in seawater; the chemical form of the metals; and the reactivity and toxicity of the chemical forms of the metals. There are six trace metals, namely, chromium, nickel, copper, cadmium, mercury, and lead, which occur in petroleum at trace levels and are toxic to at least some marine organisms at such levels. In view of their potential impact on the arctic and subarctic marine environments and organisms, these metals are considered in this report. (Sinha-OEIS)
W79-10040

ACUTE TOXICITY OF HEAVY METALS,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
For primary bibliographic entry see Field 5C.
W79-10041

PROCEEDINGS OF A WORKSHOP ON SCIENTIFIC PROBLEMS RELATING TO OCEAN POLLUTION, ESTES PARK, COLORADO, JULY 10-14, 1978,
For primary bibliographic entry see Field 5A.
W79-10049

DREDGING AND DISPOSAL OF ITS LARGE-VOLUME WASTE,
Johns Hopkins Univ., Baltimore, MD. Chesapeake Bay Inst.
M. G. Gross, W. D. Barnard, H. Bokuniewicz, C. G. Gunnerson, and M. N. Nichols.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 35-50, March 1979. 34 ref.

Descriptors: *Dredging, *Waste disposal, *Water pollution sources, Resources development, Dispersion, Outer Continental Shelf, Containment.

The discussion primarily concerns dredged material. Dredged material typically is composed mostly of inorganic sediment and often contains less than 10% organic matter by weight. However, some dredged material may contain domestic waste products. In some urban harbor areas subject to the discharge of large quantities of municipal wastes, sewage sludge may be a major component of dredged materials. Although typical dredged materials are not sewage sludge, many strategies are related to disposal of both organic-rich and organic-poor dredged sediments. Therefore, the disposal of dredged sewage sludge is included within the general framework of dredged material disposal. The discussion also considers incineration of wastes at sea, although it differs in many respects from dredging and related disposal activities. New sites must be designated for disposal of dredged materials and solid wastes. Choices must be made between containment and dispersal and each site must be evaluated on the basis of its physical, biological, and geological characteristics. (See also W79-10049) (Sinha-OEIS)
W79-10052

LITTER,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
E. J. Carpenter, W. J. Cretney, B. F. Morris, and R. L. Swanson.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 51-68, March 1979. 3 tab, 36 ref.

Descriptors: *Solid wastes, *Monitoring, *Water pollution sources, *Water pollution effects, Pollutants, Resources development, Outer Continental Shelf, Ocean pollution, Litter.

Knowledge of the role played by litter in marine ecosystems is extremely limited. This section summarizes current understanding of the litter problem, exposes critical areas that need further investigation, and recommends ways of monitoring this chronic type of pollution. The major problems deserving attention are identified as (1) identifying and quantifying specific litter materials found on widely varied areas, such as the seabed, the beaches, and the sea surface; (2) determining the sources of these materials and the associated pathways and mechanisms of transport in the marine environment; (3) understanding the fate of these forms of litter, particularly the persistence of these materials in marine areas; and (4) assessing the impacts of these materials on marine organisms and on recreational and commercial users of the sea. (See also W79-10049) (Sinha-OEIS)
W79-10053

MICROORGANISMS,
Rhode Island Univ., Kingston.
For primary bibliographic entry see Field 5C.
W79-10055

5C. Effects Of Pollution

A STUDY OF THE REUSE OF REUSED WATER,
Construction Engineering Research Lab. (Army), Champaign, IL.
For primary bibliographic entry see Field 3C.
W79-09846

EFFECT OF SELENIUM DIOXIDE ON THE ACCUMULATION AND ACUTE TOXICITY OF MERCURIC CHLORIDE IN GOLDFISH,
South Dakota Univ., Vermillion. Dept. of Biology.
J. F. Heisinger, C. D. Hansen, and J. H. Kim.
Archives of Environmental Contamination and Toxicology, Vol. 8, No. 3, p 279-283, 1979. 1 fig, 3 tab, 13 ref.

Descriptors: *Environmental effects, *Water pollution, Mercury, Fish, Toxicity, Selenium, Antagonism.

Even though whole body accumulations of total mercury were increased in goldfish which had been exposed to selenium dioxide and mercuric chloride, it was found that the acute toxicity of the mercuric chloride was decreased by the presence of the Se. At approximately equimolar concentrations of Se and Hg, maximum binding of Hg to fish occurred. At higher Se concentrations, this binding was reduced. It was also found that the greater the Hg accumulation the greater was the ability to survive a given environmental Hg concentration. (Chilton-ORNL)
W79-09901

THE EFFECT OF TEMPERATURE ON COPPER TOLERANCE OF PARAMECIUM,
Illinois Univ. at the Medical Center, Chicago. Dept. of Biological Sciences.
C. Szeto, and D. Nyberg.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, No. 1/2, p 131-135, 1979. 2 tab, 9 ref. NSF DEB 76-00126.

Descriptors: *Environmental effects, *Water pollution, Temperature, Copper, Toxicity, Protozoa, Paramecium tetraurelia.

Paramecium tetraurelia were exposed to varying copper concentrations at temperatures of 12, 20, 27, and 34 C. Results showed that copper tolerance of the paramecium decreased with increased temperatures over the range studied. It was concluded that copper toxicity to some organisms can be considerably modified by other environmental parameters. (Chilton-ORNL)
W79-09903

A MORPHOLOGICAL DEFECT IN SHINER PERCH RESULTING FROM CHRONIC EXPOSURE TO CHLORINATED SEA WATER,
Battelle Pacific Northwest Lab., Sequim, WA. Marine Researc Lab.
T. O. Thatcher.
Bulletin of Environmental Contamination and Toxicology, Vol. 21, No. 4/5, p 433-438, 1979. 1 fig, 1 tab, 12 ref. DOE EY-76-C-06-1830.

Descriptors: *Environmental effects, *Water pollution, *Chlorination, Perches, Sea water, Morphological defect, Defect.

During the course of an investigation designed to determine the effects of chlorinated sea water on the growth of shiner perch, a morphological defect to one eye was observed in 17 of 20 young shiner perch. The defect was absent in controls. Behavioral aberrations appeared to be associated with the defect. Fish with severe cases were unsuccessful at feeding and at avoiding capture by dip-net. Fish which died during the experiment varied in the degree of severity of the observable morphological aspects of the defect. (Chilton-ORNL)
W79-09907

EFFECTS OF TEMPERATURE AND COLD STORAGE ON DEVELOPMENT TIME AND VIABILITY OF EGGS OF THE BURROWING MAYFLY HEXAGENIA RIGIDA (EPHEMEROPTERA: EPHEMERIDAE),
Fisheries and Marine Service, Winnipeg (Manitoba). Freshwater Inst.
M. K. Friesen, J. F. Flannagan, and S. G. Lawrence.
The Canadian Entomologist, Vol. 111, No. 6, p 665-673, June 1979. 7 fig, 1 tab, 24 ref.

Descriptors: *Environmental effects, *Temperature, *Storage, Embryonic growth stage, Mayflies.

Mayfly eggs were monitored to determine the effect of temperature on start, hatching rate, per cent, and hatching period. Upper temperature limit for eggs transferred directly to a constant temperature and allowed to develop there was between 32 and 36 C and the lower limit was between 8 and 12 C. Success of storage varied with temperature, length of storage period, stage of embryonic development of eggs at time of transfer, and transfer method. The combination found to be best for long-term storage (up to 52 weeks) was use of middle stage eggs stored at 8 C and transfered in a stepwise manner to (4 C every 2 days) and from (4 C every 7 days) 8 C. Eggs in middle and late stage of development could be stored for up to 16 weeks at 8 C using a direct transfer method. Short-term storage was also possible at 12 C using direct transfer method. (Chilton-ORNL)
W79-09919

ANALYSIS OF NITRATE CONTENT OF SURFACE WATER AND EFFLUENT WATER. APPLICATIONS OF A PLASTIC-MEMBRANE NITRATE-SELECTIVE ELECTRODE IN WATER QUALITY MONITORS,
Philips Gloeilampenfabrieken N.V., Eindhoven (Netherlands). Application Lab.
H. C. Brinkhoff.
Environmental Science and Technology, Vol. 12, No. 13, p 1392-1394, December 1978. 4 tab, 11 ref.

Descriptors: *Nitrates, *Effluents, *Monitoring, *Membranes, *Electrodes, *Analytical techniques, Surface waters, Methodology, Instrumentation, Colorimetry, Sewage treatmen., Industrial wastes, Waste treatment, Water pollution control, Netherlands, Streams, Rivers.

Application reliability was proven for a plastic membrane nitrate-selective electrode with a quaternary ammonium salt as the ion-selective species as a means of determining nitrate contents of aerobic surface water and sewage treatment plant effluents. Under aerobic conditions only interference by chloride should be expected, with a probable deviation of under 10%. An advantage of plastic membranes is that sample pretreatment is not required. The electrode was successfully used for three months in continuous on-site analysis in two water quality monitors, Phillips models PW 9835 and WQM. Water flow at the membrane was kept at 1.5-2.0 m/sec to reduce membrane fouling, and electrodes in the PW 9835 were ultrasonically cleaned every half hour for one minute. The membrane electrode system compared favorably with a standard colorimetric method in laboratory testing. Electrodes tested were the nitrate-selective Philips IS-561-NO3 and the double-junction electrode RH44 D/2-GD/L1/SL. The reference liquid membrane electrode had 3 mol/L KCl and 0.1 mol/L MgCl2 as internal filling solutions. For colorimetric analysis a modified standard procedure was followed in which nitrate was reduced to nitrite, subsequently measured by a diazotation reaction. Laboratory tests used surface water samples from three streams (Dutch), Aa, Dommel, and Maas. (Lynch-Wisconsin)
W79-09920

AUTOTROPHY IN STREAM ECOSYSTEMS,
Idaho State Univ., Pocatello. Dept. of Biology.
G. W. Minshall.
Bioscience, Vol. 28, No. 12, p 767-771, December 1978. 2 fig, 4 tab, 46 ref.

Descriptors: *Autrotrophy, *Streams, *Deep Creek(ID), *Organic matter, *Primary productivity, *Nutrients, Lotic environment, Biological communities, Ecology, Heterotrophy, Life cycles, Biorhythms, Idaho, Macrophytes, Periphyton, Litter, Leaves, Deciduous forests, Respiration, Energy, Nutrient loading, Carbon.

Evaluation of data on several streams in a variety of vegetational environments shows that the hypothesis that streams are heavily dependent on allochthonous inputs of organic matter has been overemphasized. In many cases autotrophy is of primary importance in maintaining the structure and function of lotic communities, though supportive evidence is limited mostly because most studies have concentrated on small streams in deciduous forest areas where the importance of external organic matter is the predominant feature. Many conclusions of this paper are based on research in Deep Creek in southern Idaho, a productive hard-water stream whose streamside vegetation is dominated by sagebrush and grass. Allochthonous contributions of organic matter are trivial, and autotroph supply most energy sources for the diverse and productive community. Comparative data for several other streams show: (1) Animal diversity and productivity and community stability in autotrophic streams are comparable to heterotrophic

ones. (2) Unpolluted streams are not necessarily predominantly heterotrophic as has been believed. (3) Synchronization of life cycle phenomena among benthic invertebrates does not necessarily depend on autumnal inputs of external leaf material. In a number of the streams autotrophic production is the major or sole source of fixed carbon in the system, and even in heterotrophic streams primary production plays a fairly important role in stream economy. (Lynch-Wisconsin)
W79-09922

EXCHANGE OF CERTAIN RADIONUCLIDES BETWEEN THE ENVIRONMENT AND FRESH-WATER ALGAE,

Akademiya Nauk Litovskoi SSR, Vilnius. Inst. of Botany.
E. D. P. Marchyulenene.

The Soviet Journal of Ecology, Vol. 9, No. 2, p 163-165, March-April 1978. Translated from Ekologiya, No. 2, p 80-81, March-April 1978. 1 tab, 3 ref.

Descriptors: *Algae, *Radioisotopes, *Absorption, *Ion exchange, *Charophyta, *Cladophora glomerata, Nitella syncarpa, Nitellopsis obtusa, Chara rudis, Chara vulgaris, Strontium, Cesium, Cerium, Ruthenium, Bioaccumulation, Chuvintas Lake(U.S.S.R.), Dusya Lake(U.S.S.R.), Seasonal, Colloids, Durshyu-Mares Bay(U.S.S.R.).

Levels of both accumulation and elimination of radionuclides by freshwater algal species of Charophyta and Cladophora depended on the chemical nature of the radionuclides and on the algal species in tests with samples from Chuvintas and Dusya lakes and Kurshyu-Mares Bay, U.S.S.R. Accumulation of strontium, cesium, cerium, and ruthenium was tested with Cladophora glomerata, Nitella syncarpa, Nitellopsis obtusa, Chara rudis, and C. vulgaris. Radionuclides were introduced in the form of chlorides at 0.00001 Ci/1, and water and algal samples were examined after three hours, and 1, 2, 4, 8, and 16 days. Intensity and level of accumulation of the radionuclides were extremely varied, and were representable by the series Ce-144 > Ru-106 > Sr-90 > Cs-137. Results indicate radionuclides of the tri- and tetravalent metals cerium and ruthenium, which exist in aqueous medium primarily in a colloidal state and enter aquatic plants chiefly by absorption, are accumulated more intensively and in larger amounts than radionuclides of cerium and strontium, which exist in the aqueous phase in an ionic state and enter aquatic plants by ionic exchange. The higher levels of accumulation of strontium-90 than of cesium-137 can be explained by preferential accumulation of calcium in the algae compared to the larger relative surface/unit wt, and to its adaptation to fluctuations in water mineral composition due to discharge of Baltic Sea waters into Kurshyu-Mares Bay. (Lynch-Wisconsin)
W79-09923

AN ECOPHYSIOLOGICAL STUDY OF THE MEIOFAUNA OF THE SWARTKOPS ESTUARY. 3. PARTITION OF BENTHIC OXYGEN CONSUMPTION AND THE RELATIVE IMPORTANCE OF THE MEIOFAUNA,

Port Elizabeth Univ. (South Africa). Dept. of Zoology.
A. H. Dye, T. Erasmus, and J. P. Furstenberg.

Zoologica Africana, Vol. 13, No. 2, p 187-199, 1978. 4 fig, 3 tab, 34 ref.

Descriptors: *Swartkops Estuary(South Africa), *Meiofauna, *Nematodes, *Oxygen demand, *Benthic fauna, *Beaches, Sands, Mud flats, Ecology, Respiration, Metabolism, Secondary productivity, South Africa, Light-dark bottle method, Prawns, Callianassa draussi, Crustaceans, Microorganisms, Productivity, Temperature.

Measurement of benthic oxygen demand at a sand and a mud beach in the Swartkops Estuary near Port Elizabeth, South Africa, showed that meiofauna in these exposed areas are not quantitatively important, but may be significant qualitatively. Secondary production, measured by the light-dark bottle technique, was 82 g C/sq m/yr in sandy areas, and 863 g in muddy areas rich in the prawn Callianassa kraussi. Meiofauna production was 2.1% in sandy areas and 0.03% in the mud flats. Microorganisms accounted for the largest share of secondary production, 92% in sand and 75.5% in mud, while macrofauna accounted for 5.75% and 24.4% in the two areas. Determination of respiration rates of individual species was not attempted. Nematodes were dominant among meiofauna in both areas and so were chosen for meiofaunal respiration determinations by a polarographic micro-respirometer method. Meiofauna was extracted from the sand by the decanting technique, 50 nematodes of mean mass 0.43 microg were placed in a drop of artificial seawater in the respirometer, and readings were taken with the oxygen probe at 10, 20, and 30 C. Metabolic activity increased with temperature. Individuals from the sand beach increased in metabolic rate from 1.39 microl 02/mg ash-free dry wt at 10 C to 3.03 microl at 30 C, while specimens from the mud flat increased from 1.53 to 7.47 microl. The difference between the two sites is probably due to differences in species composition. (Lynch-Wisconsin)
W79-09924

RESERVOIR METALIMNION OXYGEN DEMANDS: DISCUSSION,

Cornell Univ., Ithaca, NY. Dept. of Civil and Environmental Engineering.
R. I. Dick, and C. A. Cairns.

Journal of the Environmental Engineering Division of the American Society of Civil Engineers, Vol. 105, No. 1, p 177-179, February 1979. 1 fig, 3 ref.

Descriptors: *Metalimnion, *Reservoirs, *Settling velocity, *Sedimentation rates, *Water temperature, *Oxygen demand, Particulates, Organic matter, Specific gravity, Density, Viscosity, Suspended solids.

The dramatic effect of temperature on particle sedimentation velocity proposed by Gordon and Skelton in 'Reservoir Metalimnion Oxygen Demands' (See W78-04202) as being responsible for the accumulation of oxygen-demanding particulate organics in a reservoir metalimnion is possible only if the specific gravity of the settling particles is 1.00, as is assumed by the authors. With particles of mass densities even as low as 1.01 g/ml the mechanism proposed is far less significant. Thus if this mechanism does in fact explain the distribution of organic particles in reservoirs, then the particle density must be nearly equal to that of water, and certainly less than 1.01 g/ml. Water temperature affects sedimentation rates because of its effect on water viscosity and density. Whereas the effect is usually greater on viscosity than on density, under circumstances considered in the article the reverse is true because the difference between the mass density of the settling particles and the mass density of the water is the factor influencing sedimentation rate, and because particles were assumed to have a specific gravity of only 1.00. An illustration is given using data for another reservoir. Other studies have reported average densities of algal cells at 1.089 g/ml, protozoan cysts at 1.057 g/ml, various organisms at 1.02-1.15, and living plankton protoplasm at about 1.05 g/ml. (Lynch-Wisconsin)
W79-09925

LOCAL AND MESOSCALE INFLUENCES ON NUTRIENT VARIABILITY IN THE NORTHWEST AFRICAN UPWELLING REGION NEAR CABO CORBEIRO,

Washington Univ., Seattle. Dept. of Oceanography.
L. A. Codispoti, and G. E. Friederich.

Deep Sea Research, Vol. 25, No. 9, p 751-770, September 1978. 14 fig, 2 tab, 47 ref.

Descriptors: *Upwelling, *Nutrients, *Cabo Corbeiro(Spanish Sahara), *Atlantic Ocean, *Winds, Spanish Sahara, Oceans, Nitrates, Ammonia, Phosphorus, Primary productivity, Advection, Continental shelf, Turbidity, Catobolism, Coasts, Meteorology, Hydrography, Silicon, Topography, Distribution, Cycles.

Much of the nutrient variability recorded during cruises of the R. V. Atlantis II March-May 1974 as part of the JOINT-1 experiment in the northwest African upwelling system off Cabo Corbeiro, Spanish Sahara, can be related to data obtained within the region rather than to large-scale processes. Local wind variations and hydrographic cycles were particularly important. Five periods of enhanced upwelling 'events' previously identified in the region help explain the data, and some of the remaining variability can be related to temporal changes in primary production, variations in cross-shelf flow, and interaction of the advective field with a longshore nutrient gradiant. Mesoscale observations made it possible to explain an anomalously high ammonia concentration over the inner shelf. A net transport of organic material into this region may have occurred, and high nearshore turbidity reduced primary production rates; these factors apparently enabled community catobolism to produce ammonia faster than it could be consumed. The general nature of the nutrient distributions near Cabo Corbeiro is probably affected by topographic features such as an undersea canyon about 30 km to the north, and by large-scale processes that could for example, alter the position of the front between North Atlantic Central Water and South Atlantic Central Water. Internal waves and spatial differentiation could also complicate the interpretation. (Lynch-Wisconsin)
W79-09926

BUDGETS OF SELECTED NATURAL MINERAL NUTRIENTS FOR A SOUTHEASTERN PIEDMONT FOREST AND PASTURE,

Georgia Univ., Athens. Inst. of Natural Resources.
J. E. Krebs.

Ph D Dissertation, June 1977, 125 p, 15 fig, 75 tab, 78 ref, 1 append.

Descriptors: *Watersheds(Basins), *Ecosystems, *Forest watersheds, *Pastures, *Nutrient budgets, Nutrients, Cycling nutrients, Georgia, Bishop F. Grant Memorial Forest(GA), Central Georgia Branch Experiment Station(GA), Land management, Streams, Sediments, Piedmont, Cattle, Water pollution sources, Agricultural runoff, Soil types, Precipitation(Atmospheric), Hydrology, Sodium, Potassium, Calcium, Lead, Iron, Magnesium.

A comparison of mineral nutrient budgets 1974-76 for two Georgia piedmont watershed ecosystems, a mixed pine-hardwood forest and a pasture for brood cows, showed that: (1) ecosystems maintained at early succession stages such as pastures lose larger quantities of nutrients than successional forest communities; (2) a mixed pine-hardwood ecosystem is accumulating most essential nutrients, suggesting continuing increase in biomass; and (3) even the forest piedmont stream does not meet EPA water quality criteria for all elements. In the latter iron and manganese ranges too high for domestic use, and iron, manganese, and phosphorus for domestic and irrigation use, as well as for most aquatic life. The forest ecosystem is in the Bishop F. Grant Memorial Forest, and the pasture is at the Central Georgia Branch Experiment Station, Eatonton, Georgia. The 40-ha forest was a cotton field until the early 1920s, then was allowed to return to forest. The 10-ha pasture was formerly a peach orchard, but has been a pasture for 25 yrs. Forest soils composition are Mecklenburg (24%), Cecil (17%), Iredell (13%), Appling (13%), and Hiwassee (11%). Pasture soils are in the Cecil and Davidson series. The two watersheds show very similar patterns of the elements studied; both accumulate cadmium, chromium, copper, potassium, phosphorus, lead, and zinc, and both lose aluminum, calcium, cobalt, manganese, and sodium. The only exception is magnesium, accumulated in the pasture and lost in the forest. (Lynch-Wisconsin)
W79-09927

EFFECTS OF CALCIUM ADDITION AS CA(NO3)2 ON ZINC TOXICITY TO FATHEAD MINNOWS, PIMEPHALES PROMELAS, RAFINESQUE,

North Texas State Univ., Denton. Dept. of Biological Sciences.
R. D. Judy, Jr., and P. H. Davies.

Bulletin of Environmental Contamination and Toxicology, Vol. 22, No. 1/2, p 88-94, 1979. 2 fig, 3 tab, 14 ref.

Descriptors: *Environmental effects, *Water quality, Toxicity, Zinc, Calcium, Fish, Chemical interaction, Antagonism, Fathead minnows, Pimephales promelas.

The role which calcium plays in inhibition of zinc toxicity was examined using fathead minnows as the tent organisms. It was shown that calcium in solution does inhibit the toxicity of zinc to these organisms. The physiological interactions of calcium and zinc have not been investigated and it was suggested that long-term testing needs to be done on this problem. Water quality criteria for safe zinc levels are affected by the antagonistic influence of calcium to the toxicity of zinc. (Chilton-ORNL)
W79-09928

REDUCTION OF BLOOD PLASMA COPPER CONCENTRATIONS IN A MARINE FISH FOLLOWING A SIX MONTH EXPOSURE TO CRUDE OIL,
Memorial Univ. of Newfoundland, St. John's. Marine Sciences Research Lab.
G. L. Fletcher, J. W. Kiceniuk, M. J. King, and J. F. Payne.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, No. 4/5, p 548-551, 1979. 1 tab, 12 ref.

Descriptors: *Environmental effects, *Water pollution, Oil, Fish, Copper, Blood plasma.

Cunner (Tautogolabrus adspersus) were continuously exposed to a surface slick of Venezuelan crude oil for six months. Examination of blood plasma at the end of this period showed that copper concentrations were significantly lower in oil exposed female cunner than in controls. The few values obtained for males were similar. Plasma Ca, Mg, Zn and total proteins did not differ significantly between fish exposed to oil and controls. (Chilton-ORNL)
W79-09931

INFLUENCES OF HARDNESS CONSTITUENTS ON THE ACUTE TOXICITY OF CADMIUM TO BROOK TROUT (SALVELINUS FONTINALIS),
Environmental Protection Agency, Washington, DC. Office of Water and Waste Management.
J. J. Carroll, S. J. Ellis, and W. S. Oliver.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, No. 4/5, p 575-581, 1979. 3 tab, 11 ref.

Descriptors: *Environmental effects, *Water pollution, Cadmium, Mortality, Trout, Calcium, Protection, Toxicity.

These investigations were designed to determine the contribution of each of several components of hardness to the protection of brook trout against cadmium toxicity. From LC50 data obtained in different test waters, it is clear that calcium ion is very protective while magnesium, sodium and sulfate ions and the carbonate system give little or no protection. While precipitation may have influenced LC50 values slightly, it was concluded that the influence could not have been great because precipitation amounted to no more than about 40% of the cadmium present. No precipitation was detected at 15 microg/l nominal concentration, a level at which 90 to 100% mortality was observed in waters low in calcium but at which little or no mortality was observed in waters high in calcium. (Chilton-ORNL)
W79-09932

TRACE METAL UPTAKE BY THREE SPECIES OF MOLLUSKS,
National Marine Fisheries Service, Milford, CT. Milford Lab.
R. A. Greig.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, No. 4/5, p 643-647, 1979. 3 tab, 7 ref.

Descriptors: *Environmental effects, *Water pollution, Absorption, Silver, Cadmium, Copper, Clams, Oysters, Ocean quahogs.

This study examines the uptake of silver, cadmium, and copper by ocean quahogs, surf clams, and oysters when they were exposed to all metals simultaneously. The oyster took up all metals to a greater extent than either the quahog or surf clam. Surf clams took up nearly as much silver as did oysters, especially at 20 ppb exposure level. Ocean quahog took up an amount of silver similar to the amount it took up of copper. (Chilton-ORNL)
W79-09933

LABORATORY STUDIES ON THE DIRECT EFFECT OF TEMPERATURE ON THE FRESHWATER VECTOR SNAIL, INDOPLANORBIS EXUSTUS (DESHYES),
Marathwada Univ., Aurangabad (India). Dept. of Zoology.
D. P. Vaidya, and R. Nagabhushanam.
Hydrobiologia, Vol. 61, No. 3, p 267-271, 1978. 4 fig, 1 tab, 19 ref.

Descriptors: *Environmental effects, *Thermal stress, Temperature, Snails, Embryonic growth stage, Mature growth stage, Growth rates, Hatching, Incubation, Mortality.

Lower lethal temperature for young snails was found to be 7.0 C and for adult snails, 7.5 C. Upper lethal temperature was 34.0 C for young and 32.0 C for adult snails. Lower lethal temperature of embryos was about 10.0 C and the upper lethal temperature was about 36.5 C. Within these extremes hatching rates showed no considerable differences but embryonic development was accelerated and the incubation period shortened as the water temperature rose. Incubation period for eggs ranged from 25 days at 15.0 C to 7 days at 35.0 C. Growth rate of embryos reached a maximum at 25.0 C. This was also the optimum temperature for egg laying. (Chilton-ORNL)
W79-09934

MERCURY CONTAMINATION OF FISH IN GUATEMALA,
Unified Food Control Lab., Guatemala City.
A. Ramos, M. de Campos, and A. E. Olsyna-Marzys.
Bulletin of Environmental Contamination and Toxicology, Vol. 22, No. 4/5, 1979, p 488-493. 3 tab, 9 ref.

Descriptors: *Environmental effects, *Water pollution, Mercury, Fish, Guatemala, Shellfish, Absorption.

214 specimens of 19 species of finfish and 89 specimens of 4 classes of shellfish were analyzed for mercury contamination. Results of the analyses showed that mercury contamination of finfish and shellfish in Guatemala does not present a big problem even though a few samples had high residue levels. It was recommended that local fish should be analyzed regularly for mercury contamination. (Chilton-ORNL)
W79-09939

THE DEVELOPMENT OF THE EGGS AND EARLY LARVAE OF BLUE WHITING, MICROMEISISTIUS POUTASSOU, AND THE EFFECT OF TEMPERATURE ON DEVELOPMENT,
Institute for Marine Environmental Research, Plymouth (England).
S. H. Coombs, and A. R. Hiby.
Journal of Fish Biology, Vol. 14, No. 1, p 111-123, January 1979. 5 fig, 4 tab, 30 ref.

Descriptors: *Environmental effects, *Thermal pollution, *Temperature, Embryonic growth stage, Hatching, Larvae, Mortality, Fish, Blue whiting, Micromesistius poutassou.

Blue whiting eggs were artificially fertilized and incubated at temperatures ranging from 1 to 18 C. Rate of embryonic development was found to increase with increasing temperature. Time from fertilization to hatching decreased from 205 h at 6 C to 70 h at 15 C. Optimal survival rate of 70% was seen between 6 and 10 C. The upper limit for successful development of blue whiting eggs was found to be about 14.5 C. The lower limit was not established because of the long incubation times but it was estimated that successful hatching does not occur under natural conditions below 5 C. (Chilton-ORNL)
W79-09942

AN INVESTIGATION OF PLUTONIUM CONCENTRATION AND DISTRIBUTION IN A BURROWING CRAYFISH FROM THE WHITE OAK CREEK FLOODPLAIN,
Oak Ridge National Lab., TN.
M. S. Delaney, R. C. Dahlman, and R. B. Craig.
Available from the National Technical Information Service, Springfield, VA 22161 as ORNL/TM-6702, Price codes: A06 in paper copy, A01 in microfiche. ORNL/TM-6702. January 1979. 101 p. 9 fig, 13 tab, 60 ref, 4 append.

Descriptors: *Environmental effects, Plutonium, Absorption, Crayfish, Radiation, Soil contamination, Soils, White Oak Creek, Tennessee, Bioaccumulation.

The number of contaminated crayfish estimated to be at two sites on the White Oak Creek floodplain in 1977 was from 84 to 110. Average Pu239 concentrations in contaminated crayfish were more than one hundred times greater than in control crayfish. The floodplain soil surpassed background level soil by three orders of magnitude. Average Pu239 concentration in digestive tracts of contaminated crayfish was 6 to 8 times greater than in their soft tissues and 8 to 15 times greater than in their carapaces. Pu239 concentration in unfiltered water appeared to relate to that in the soft tissues. It was concluded that biomagnification with respect to soil Pu is not a concern and that estimated whole body radiation dose either to man after ingesting Pu239 in the soft tissues of ten crayfish from the White Oak Creek floodplain or to other predators is inconsequential in comparison with background radiation. (Chilton-ORNL)
W79-09943

AN EMPIRICAL MODEL OF IMPINGEMENT IMPACT,
Oak Ridge National Lab., TN.
L. W. Barnthouse, D. L. DeAngelis, and S. W. Christensen.
Available from the National Technical Information Service, Springfield, VA 22161 as NUREG-CR0639, Price codes: A02 in paper copy, A01 in microfiche. NUREG/CR-0639; ORNL/NUREG/TM-290. February 1979. 20 p. 3 tab, 16 ref.

Descriptors: *Environmental effects, *Model studies, Mortality, Populations, Juvenile fish, Powerplants, Impingement.

The model described in this paper can be used to estimate the impact of impingement of juvenile fish by power plants on year-class abundance in vulnerable species. In the model, the impact of impingement is expressed as the conditional mortality rate and the data required are estimates of initial number of impingeable juveniles, number impinged, and rate of total mortality during the period of vulnerability. Conditional mortality rate is said to be superior to exploitation rate as a measure of impact because it accounts for the differential impact of impinging fish of different ages and it is numerically equivalent to the fractional reduction in year-class abundance due to impingement. An application of the model is presented using the 1974 year-class of the Hudson River striped bass population as an example. (Chilton-ORNL)
W79-09944

THERMAL BEHAVIORAL RESPONSES OF THE SPECKLED SANDDAB, CITHARICHTHYS STIGMAEUS: LABORATORY AND FIELD INVESTIGATIONS,
Occidental Coll., Los Angeles, CA. Dept. of Biology.
K. F. Ehrlich, J. S. Stephens, G. Muszynski, and J. M. Hood.
Fishery Bulletin, Vol. 76, No. 4, p 867-872, 1979. 4 fig, 2 tab, 17 ref.

Descriptors: *Environmental effects, *Thermal stress, Temperature, Fish, Distribution, Laboratory tests, On-site investigations, California, Speckled sanddabs, Citharichthys stigmaeus.

The effects of acclimation temperature, size and sex of speckled sanddabs on their temperature selection was examined. Sanddabs were collected from King Harbor, Redondo Beach, California, an area which receives thermal effluent as well as cold upwelled water. Peak abundance of sanddabs in King Harbor occurred from winter through spring and early summer when bottom temperatures were low. During late summer and fall breakdown of stratification, warm bottom water was associated with a pronounced decrease in the number of fish. A high correlation between field observations and temperatures selected in the laboratory indicates that field distribution may be explained by temperature. Laboratory data also indicated that the water in King Harbor is usually warmer than that preferred by sanddabs and that they may be under stress and more susceptible to infection in the area. (Chilton-ORNL)
W79-09945

THERMAL BEHAVIORAL RESPONSES OF SELECTED CALIFORNIA LITTORAL FISHES,
Occidental Coll., Los Angeles, CA. Dept. of Biology.
K. F. Ehrlich, M. J. Hood, G. Muszynski, and G. E. McGowen.
Fishery Bulletin, Vol. 76, No. 4, p 837-849, 1979. 7 fig, 1 tab, 47 ref.

Descriptors: *Environmental effects, *Thermal pollution, *Temperature, Fish behavior, Fish, Littoral, California, Temperature.

Two horizontal temperature gradients (one for juveniles and adults and another for larvae) were used to measure behavioral responses to temperature of 16 species of temperate marine fish. Behavioral responses were classified using eight environmental parameters: initial, mean, modal, and final selected temperatures; ranges of selected temperatures; skewness; kurtosis; and the degree of dispersion between individuals. It was found that the effects of preexperimental acclimation temperatures influenced selection temperatures for only about 4 hr. A day of food deprivation caused fish to select lower temperatures and also changed the precision of selection and aggregating tendencies. The direction of this change varied between species. (Chilton-ORNL)
W79-09946

EFFECTS OF SUDDEN TEMPERATURE SHIFTS ON PURE CULTURES OF FOUR STRAINS OF FRESHWATER BACTERIA,
Konstanz (Germany, F.R.), Limnolog Inst.
M. G. Hofle.
Microbial Ecology, Vol. 5, No. 1, p 17-26, 1979. 7 fig, 2 tab, 20 ref.

Descriptors: *Environmental effects, *Temperature, Bacteria, Growth rates, Freshwater.

Effects of sudden temperature increases on growth rates and substrate conversion in Cytophaga johnsonae, Cytophaga sp., Pseudomonas fluorescens, and Enterobacter cloacae were investigated. Growth rate in the shift-up cultures from 5 to 10 C decreased for Cytophaga sp., remained the same for C. johnsonae, and increased for P. fluorescens in comparison to 10 C basic culture. Substrate conversion increased in all cases immediately after shift-up. The extracellular substrate conversion of glucose to gluconate and 2-ketogluconate by P. fluorescens was particularly affected by sudden temperature increase. (Chilton-ORNL)
W79-09948

EFFECT OF A STEAM ELECTRIC GENERATING STATION ON THE EMERGENCE TIMING OF THE MAYFLY, HEXAGENIA BILENEATA,
Oak Ridge National Lab., TN.
J. S. Mattice, and L. L. Dye.
Verh. Internat. Verein. Limnol., Vol. 20, p 1752-1758, November 1978. 4 fig, 1 tab, 15 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Electric power, Thermal powerplants, Growth stages, Mayflies, Emergence.

Emergence of mayflies were observed at three areas of study near a steam electric generating plant; the intake canal, a reference cove, and the discharge cove. In the discharge cove, a thermocline develops in spring and remains until fall. The other areas are unstratified. Water temperatures in the three areas follow typical seasonal trends of a temperate area except that the discharge cove temperature above the thermocline averaged 5 C higher than intake canal and 3.1 C higher than reference cove. Below the thermocline discharge water temperature was similar to intake water temperature. Data from traps in each cove indicated that emergence timing in the intake and reference sites were not significantly different but the discharge site was significantly earlier. It was suggested that these observed differences in emergence timing are primarily a function of temperature. (Chilton-ORNL)
W79-09949

THE FRESHWATER LITTORAL MEIOFAUNA IN A SOUTH CAROLINA RESERVOIR RECEIVING THERMAL EFFLUENTS,
South Carolina Univ., Columbia. Belle W. Baruch Inst. for Marine Biology and Coastal Research.
B. J. Oden.
Freshwater Biology, Vol. 9, p 291-304, 1979. 5 fig, 3 tab, 56 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Aquatic animals, Freshwater, Reservoirs, Cooling water, South Carolina, Populations, Density, Species diversity.

Sampling was conducted monthly from September 1975 to October 1976 at three sites in the cooling reservoir of Savannah River Plant. At the ambient site temperature ranged from 8-37 C, at a warm-water site from 13 to 37 C, and at a hot-water site from 15 to 40 C. Total numbers of individuals at the ambient site ranged from 971 to 3674/10 sq cm with nematodes, rotifers, ostracods, cladocerans and mites comprising 80% overall density. At the two thermally affected sites, density as well as species diversity were reduced. However, high equitability among the reduced species resulted in Shannon-Weaver diversity index values which were comparable to those in natural communities. Distinct winter-spring and summer-autumn assemblages were seen in the ambient community which were absent from the thermally affected sites. It was suggested that maintenance of above normal temperatures masks environmental cues which normally elicit seasonal changes. (Chilton-ORNL)
W79-09950

GROWTH, FEEDING AND MORTALITY OF LARVAL AND EARLY POSTLARVAL STAGES OF THE OCEANIC SHRIMP SERGESTES SIMILIS HANSEN,
Scripps Institution of Oceanography, La Jolla, CA.
M. Omori.
Limnology and Oceanography, Vol. 24, No. 2, p 273-288, 1979. 6 fig, 8 tab, 32 ref.

Descriptors: *Environmental effects, *Thermal pollution, Temperature, Shrimps, Growth rates, Mortality, Feeding rates, Growth stages, Larval growth stage, Hatching.

Hatching viability, growth, mortality, and feeding of Sergestes similis reared from egg to 8th postlarval stage were investigated at temperatures of 6, 10, 14, and 18 C. Hatching viability of eggs released 12 h after capture averaged 90% at 10, 14, and 18 C but dropped to 32% at 6 C. Development rate of eggs was fastest at 18 C. Development of larvae was also slower at lower temperatures. Gross growth efficiency averaged 32% in larval and postlarval stages. Growth rates were higher in protozoeal and zoeal stages. Filtering, clearance, and ingestion rates increased with increasing body weight and with particle size. (Chilton-ORNL)
W79-09951

THE EFFECTS OF TEMPERATURE AND DIFFERENT FOOD ORGANISMS ON THE RATE OF GASTRIC EVACUATION IN PERCH (PERCA FLUVIATILIS),
Lund Univ. (Sweden). Limnological Inst.
L. Persson.
Freshwater Biology, Vol. 9, p 99-104, 1979. 3 fig, 4 tab, 23 ref.

Descriptors: *Environmental effects, *Temperature, Perches, Foods, Size, Rates, Gastric evacuation, Perca fluviatilis.

The rate of gastric evacuation in perch was studied at different seasons and at different temperatures (ranging from 4.0 to 21.7 C) with G. pulex as the principal food organisms. Rate of gastric evacuation was empirically described by an exponential function. The relation between instantaneous evacuation rate (R) and temperature was also described by an exponential function. No differences were found in evacuation rate for different size classes of fish. No significant differences were found in evacuation rate for several food organisms (Gammarus pulex, Chaoborus, chironomids and zooplankton). These results are compared with previously obtained results for other species. (Chilton-ORNL)
W79-09952

THE INFLUENCE OF SOME ECOLOGICAL FACTORS ON THE METABOLISM-TEMPERATURE CURVE OF THE LARVAE OF LIMNEPHILUS RHOMBICUS, (TRICHOPTERA, LIMNEPHILIDAE),
Lyon-1 Univ., Villeurbanne (France). Dept. de Biologie Animaux et Zoologie.
C. Roux.
Freshwater Biology, Vol. 9, p 111-117, 1979. 3 fig, 1 tab, 28 ref.

Descriptors: *Environmental effects, *Temperature, *Metabolism, Larvae, Adaptation, Lentic environment, Insects, Caddisflies, Limnephilus rhombicus.

Oxygen uptake of Limnephilus rhombicus was measured under three experimental conditions: (A) in still water with a plastic mesh substrate, (B) in stirred water with a plastic mesh substrate, and (C) in still water without any substrate. These measurements were compared with previously obtained data for the larvae of Micropterna testacea. Metabolism-temperature curves for L. rhombicus showed little difference between A and C except for a peak at 15 C for curve A. Larvae did not appear to be influenced by the presence or absence of substrate. Between 5 and 10 C, all three curves showed a plateau. An increase in oxygen uptake occurred between 10 and 15 C. The main difference seen between L. rhombicus and M. testacea was in their adaptation to temperature. L. rhombicus are adapted to lower temperatures and to more variable biotopes. (Chilton-ORNL)
W79-09953

EFFECTS OF WATER-SOLUBLE CHLORINE-CONTAINING ORGANICS ON AQUATIC ENVIRONMENTS--ANOTHER PERSPECTIVE,
Oak Ridge National Lab., TN.
J. R. Trabalka, and M. B. Burch.
Toxicology Letters, Vol. 3, p 201-207, 1979. 3 tab, 17 ref.

Descriptors: *Environmental effects, *Water pollution, *Chlorination, Toxicity, Organic compounds, Chlorine, Carp, Embryonic growth stage.

Previously reported investigations indicated that 5-chlorouracil and 4-chlororesorcinol significantly lowered hatching success of carp eggs at 5 microg/l and that 5-chlorouracil delayed and reduced initial production of offspring in Daphnia magna at 10 microg/l. This paper supports more recent work which indicates that these compounds may be far less toxic. Data also indicate the toxicity of synthetic effluents can be attributed to the phenolic content, primarily to the combined toxicity of chlorophenols. (Chilton-ORNL)
W79-09954

UPPER LIMITS OF THE DEPTH RANGE AND TEMPERATURE TOLERANCE OF THE BALTIC PONTOPOREIA AFFINIS (CRUSTACEA, AMPHIPODA),
Institute of Marine Research, Helsinki (Finland). Biological Lab.
S. G. Segerstrale.
Ann. Zool. Fennici, Vol. 15, p 200-201, 1978. 1 fig, 12 ref.

Descriptors: *Environmental effects, Temperature, Distribution, Amphipods, Finland, Depth, Populations, Density, Resistance, Temperature tolerance.

This paper reports the occurrence of Pontoporeia affinis, a cold-stenothermal glacial relicit, in the Tvarminne area. In this area the amphipod has been found to occur abundantly at depths much shallower than in other studies and also at higher temperatures. In the Krogarviken locality, this amphipod tolerated about 22 C at a depth of 3 m during 4 successive days. Temperature records showed high population densities of the species in years with summer temperatures exceeding 18 and 19 C. (Chilton-ORNL)
W79-09956

CHANGES IN THE AQUATIC FLORA ALONG A STRETCH OF THE RIVER UMEALVEN, N. SWEDEN, FOLLOWING HYDROELECTRIC EXPLOITATION,
Umea Univ. (Sweden). Dept. of Ecological Botany.
C. Nilsson.
Hydrobiologia, Vol. 61, No. 3, p 229-236, 1978. 2 fig, 59 ref.

Descriptors: *Environmental effects, *Hydroelectric plants, Aquatic plants, Rivers, Sweden, Distribution, Ecological distribution, Abundance.

This study attempts to use comparative floristic analyses of the aquatic flora along a river, before and after hydro-electric work, as a measure of ecological change. The report lists 45 phanerogamic taxa which have been found in the study area. It is suggested that ecological factors such as frost action, silting, water flow and water-level amplitude have affected abundance and distribution of some species but it is doubtful that more than a few have disappeared. (Chilton-ORNL)
W79-09957

TOXICITY OF GALLIUM AND BERYLLIUM TO DEVELOPING CARP EGGS (CYPRINUS CARPIO) UTILIZING COPPER AS A REFERENCE,
Oak Ridge National Lab., TN.
S. G. Hildebrand, and R. M. Cushman.
Toxicology Letters, Vol. 2, p 91-95, 1978. 1 fig, 17 ref.

Descriptors: *Environmental effects, *Water pollution, *Analytical techniques, Toxicity, Carp, Hatching, Copper, Beryllium, Gallium, Reference element.

Carp eggs were exposed to copper, beryllium, and gallium and the percentage hatch to viable fry was used as the measure of toxicity. Concentrations of copper below 0.09 ppm and beryllium below 0.08 ppm did not reduce hatching success below the control level. Concentrations of gallium below 2.4 ppm did not reduce hatching success. No eggs hatched at concentrations above 0.7 ppm copper and 0.2 ppm beryllium. At 17 ppm gallium hatching success was completely inhibited but the data does not indicate the effect of gallium on hatching success at concentrations between 2.4 and 17 ppm. It was concluded that the technique of using hatching success as an endpoint and a reference element is a potentially useful screening tool. (Chilton-ORNL)
W79-09958

FACTORS AFFECTING THE BURROWING ACTIVITY OF MACOMA BALTHICA (L.),
Helsinki Univ. (Finland). Tvarminne Zoological Station.
J. Eldon, and R. Kristoffersson.
Ann. Zool. Fennici, Vol. 15, p 127-131, 1978. 6 fig, 17 ref.

Descriptors: *Environmental effects, *Animal behavior, *Temperature, Size, Sediment, Salinity, Feeding rates, Cadmium, Laboratory tests, Macoma balthica, Burrowing activity.

The effects of size, water temperature, bottom quality, salinity, starvation, and cadmium exposure on the burrowing activity of M. balthica were tested under laboratory conditions. It was noted that small animals burrowed more rapidly than large ones but the reasons for this were not clear. Temperature had a clear effect on burrowing activity as evidenced by the fact that animals were more active at 16 C than at 4 C. Diminished burrowing activity was noted when specimens had been kept on a hard bottom for 2-3 days. When they were transferred to a soft bottom their burrowing was retarded. Keeping Macoma for 3 months at 14 C without food seemed to affect only the small animals which presumably have a higher metabolic rate so that starving affects them sooner. Burrowing activity was completely inhibited in animals exposed to cadmium concentrations of 2 and 5 ppm for 24 h. At 1 ppm cadmium, burrowing activity was diminished. Exposure to 0.5 ppm cadmium resulted in an increase in burrowing activity followed by a decrease. (Chilton-ORNL)
W79-09959

EFFECTS OF ARTIFICIAL RISE OF TEMPERATURE ON STAGNANT WATERS AND THEIR BIOCENOSES,
Polish Academy of Sciences, Poznan. Dept. of Agrobiology.
E. Biesladka, K. Kasprzak, and J. Kolasa.
Int. Revue ges. Hydrobiol., Vol. 63, No. 1, p 41-56, 1978. 2 fig, 1 tab, 42 ref.

Descriptors: *Environmental effects, *Temperature, *Thermal pollution, Powerplants, Aquatic organisms, Ecosystems, Populations, Biological communities.

Investigations of some components of bottom fauna (Turbellaria, Oligochaeta, Hirudinea, Coleoptera, Hydracarina) of the heated Konin lakes are reported. Results showed a decrease in number and an elimination of species with more strict thermic and oxygen requirements, an increase in number and abundance of more eurytopic forms and an appearance as well as quantitative progress of thermophilous species. Hydracarina exhibited a multiplication in the number of generations as a result of temperature increase. Three kinds of adaptations may be distinguished on the individual and population levels: pseudoadaptations, translocation of potentially affected populations beyond heated water influence; physiological adaptations, rebuilding of physiological processes; and phenological adaptations, changing of seasonal cycles to suit new conditions. The newly formed biocenosis is markedly different from the aboriginal one. (Chilton-ORNL)
W79-09960

INFILTRATION AS INFLUENCED BY IRRIGATION WATER QUALITY,
Science and Education Administration, Riverside, CA. Salinity Lab.
J. D. Oster, and F. W. Schroer.
Soil Science Society of America Journal, Vol. 43, No. 3, p 444-447, May-June 1979. 2 fig, 3 tab, 11 ref.

Descriptors: *Infiltration, *Water quality, *Soil water, *Irrigation water, Salinity, Soils, Loam, Hydraulic conductivity, Sodium, Calcium carbonate, Cation exchange, Cations, Chemical properties, Physical properties, Soil properties, Sampling, Laboratory tests, Heimdal loam.

After 19 months of irrigation with waters of different quality, columns of Heimdal loam cropped to alfalfa had infiltration rates that were correlated better with irrigation water sodicity and salinity than with soil surface (0-76 mm) or column average (0-530 mm) exchangeable sodium and soil salinity. Two sets of irrigation water parameters were tested: (1) total cation concentration (C sub c) in mol sub c/cu m (meq/l) and sodium adsorption ratio (SAR sub c) of the irrigation water in equilibrium with solid phase CaCO3 at a PCO2 of 0.07% based on ion activities corrected for ion pairing; and, (2) total cation concentration of the irrigation water as prepared, and the adjusted sodium adsorption ratio based on the calculated pH of the water in equilibrium with CaCO3. On the basis of multiple linear regression analyses, the best correlation was obtained with the lime-equilibrated water parameters (R sq = 0.87). The corresponding relationship between infiltration rate (I) in mm/hour and the chemical parameters was I = 6.80 - 1.10 SAR sub c + 0.79 C sub c. Cation concentration greatly affected infiltration rates, even at low SAR levels (2 less than SAR less than 5). Apparently, the mechanical action of the applied water greatly enhances the effects of exchangeable sodium and soil solution concentration on swelling and dispersion at the soil surface which, in turn, has a large effect on infiltration rates. (Humphreys-ISWS)
W79-09989

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13C: HYGIENIC IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 5F.
W79-10008

TRANSIENT EFFECTS OF OCEAN WASTEWATER SLUDGE DUMPING,
National Marine Fisheries Services Highlands, NJ. Sandy Hook Sport Fisheries Marine Lab.
A. F. J. Draxler.
Journal Water Pollution Control Federation, Vol. 51, No. 4, p 741-748, April 1979. 5 fig, 18 ref.

Descriptors: *Waste water disposal, *Sludge disposal, *Water pollution effects, Environmental effects, New York, New Jersey, *Outer Continental Shelf, New York bight, Ocean dumping.

Wastewater sludge from the New York metropolitan area is barged to a site approximately 22-km equidistant between Long Island, New York and Sandy Hook, New Jersey where it is dumped in water 29-m deep. The sludge contains approximately 5% solids, which are 55% organic material and has a large nutrient and heavy metal content. The purpose of these experiments was to investigate the dynamic processes that follow a single sludge dump: the settling of particulates, the dilution of nutrients, and the changes in oxygen concentration of the receiving water. (Sinha-OEIS)
W79-10029

MONITORING THE TEMPORAL DISPERSION OF A SEWAGE SLUDGE PLUME,
National Aeronautics and Space Administration, Langley Station. Langley Research Center.
R. W. Johnson, R. M. Glasgow, I. W. Duedall, and J. R. Proni.
Photogrammetric Engineering and Remote Sensing, Vol. 45, No. 5, p 763-768, June 1979. 7 fig, 3 tab, 8 ref.

Descriptors: *Monitoring, *Sewage disposal, *Sewage sludge, *Water pollution, *Suspended solids, Remote sensing, Environmental effects, Dispersion, *Outer Continental Shelf, *New York Bight, *Ocean dumping, Plumes.

Sewage sludge from the Metropolitan New York City area is dumped in the apex of the New York Bight. Possible environmental effects due to this dumping are being studied. Results of a joint National Aeronautics and Space Administration (NASA), National Oceanic and Atmospheric Administration (NOAA), and State University of New York (SUNY) experiment on July 15, 1976, indicate remotely sensed monitoring and data analysis techniques may be used to study temporal dispersion characteristics of plumes resulting from dumping of sewage sludge. Remotely sensed data

were collected by multispectral scanner and photography from a NASA aircraft platform. Multiple flights were made over the plume from a spot dump (rapid discharge from a stationary barge) at about 15 min. intervals for two hours after the dump, which was made at 10 A.M. (local time). Afternoon flights over the dump area indicated that the plume was well dispersed by about five hours after the dump. Concurrent sea-truth measurements were made from NOAA and SUNY ships in and around the dump plume. Concentrations of suspended solids in the plume were correlated with multispectral scanner radiance data to obtain a regression equation which was then used to map quantitative distributions of suspended solids in the plume. For the spot dump monitored, reflected radiances from the surface waters reached peak values about 45 minutes after the dump. After this time, spectral analysis indicated that the calibrated equation could be applied. The plume was dispersed within about five hours. (Sinha-OEIS)
W79-10030

ECOLOGICAL AND PHYSIOLOGICAL/TOXICOLOGICAL EFFECTS OF PETROLEUM ON AQUATIC BIRDS. A SUMMARY OF RESEARCH ACTIVITIES FY 76 THROUGH FY 78,
Fish and Wildlife Service, Laurel, MD. Patuxent Wildlife Research Center.
L. F. Stickel, and M. P. Dieter.
U.S. Fish and Wildlife Service, Biological Services Program Report No. FWS/OBS-79-23, July 1979. 16 p, 3 fig, 7 tab, 9 ref, 2 append.

Descriptors: *Birds, *Oil pollution, *Water pollution effects, *Toxicity, Aquatic animals, Ecology, Physiology, Oil spills, Great Lakes, *Outer Continental Shelf, Petroleum development, Aquatic birds.

The physiological and ecological effects of oil on waterbirds were examined in a series of laboratory and field experiments. Chemical methodology was developed in support of these studies. Research conducted from 1 July 1975 to 30 September 1978 by the U.S. Fish and Wildlife Service (FWS) about the effects of petroleum on aquatic birds is summarized. The following assessments were made: effects of oiling on hatchability of eggs; effects of oil ingestion on physiological condition and survival of birds; effects of oil ingestion on reproduction in birds; accumulation and loss of oil by birds; and development of analytical methods for identification and quantification of oil breakdown products in tissues and eggs of ducks. (Sinha-OEIS)
W79-10031

DISTRIBUTION AND ABUNDANCE OF SOME EPIBENTHIC INVERTEBRATES OF THE NORTHEASTERN GULF OF ALASKA WITH NOTES ON THE FEEDING BIOLOGY OF SELECTED SPECIES,
Alaska Univ., Fairbanks. Inst. of Marine Science.
H. M. Feder, and S. C. Jewett.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 4: Biological Studies, p 1-74, March 1979. 12 fig, 14 tab, 48 ref, append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Benthos, *Invertebrates, *Baseline studies, *Water pollution effects, Resources development, Oil pollution, Bioindicators, Environmental effects, Alaska, *Outer Continental Shelf, Gulf of Alaska, Petroleum development.

The intensive trawl study considered in this report delineates the major epifauna on the northeastern Gulf of Alaska shelf. The information obtained on faunal composition and abundance in this investigation now represents a general data base to which future changes can be compared. Long-term studies on life histories and trophic interactions should ultimately define functional aspects of communities and ecosystems vulnerable to environmental damage, and should help determine rates at which damaged environments can recover. The trawl survey was effective, and excellent spatial coverage was obtained. One hundred and thirty-three (133) stations were successfully occupied. Taxonomic analysis delineated 9 phyla, 19 classes, 82 families, 124 genera, and 168 species of invertebrates. Mollusca, Arthropoda (Crustacea), and Echinodermata dominated in species representation with 47, 42, and 36 species taken, respectively. The same phyla dominated in biomass, with Arthropoda contributing 71.4% of the total, Echinodermata with 19%, and Mollusca with 4.6%. The snow crab, Chionoecetes bairdi, contributed 66.2% of the total epifaunal invertebrate biomass. Other arthropods of significant biomass were the pink shrimp, Pandalus borealis, and the box crab, Lopholithodes foraminatus. Benthic invertebrates are useful as indicator species for a disturbed area because they tend to remain in place, typically react to long-range environmental changes and generally reflect the nature of the substratum. (Sinha-OEIS)
W79-10033

FINFISH RESOURCE SURVEYS IN NORTON SOUND AND KOTZEBUE SOUND,
Alaska Dept. of Fish and Game, Anchorage.
L. H. Barton.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 4: Biological Studies, p 75-313, March 1979. 85 fig, 55 tab, 48 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Baseline studies, *Water pollution effects, Oil pollution, Environmental effects, Resources development, Alaska, *Outer Continental Shelf, *Finfish, Petroleum development, Fishery surveys.

An evaluation of the subsistence use of Pacific herring and other fishery resources to coastal residents in Norton Sound and Kotzebue Sound is given. Contamination of important spawning, rearing and/or overwintering areas from petroleum related activities could destroy one or more year classes, resulting in either a general weakening and decline in populations or possible elimination of an entire population, depending upon the severity and extent of pollution. Some concerns related to petroleum exploration and development and the potential impact of oil spills on the fishery resources throughout the study area are discussed. A major concern is the absence of data on distribution, relative abundance, range, age structures, etc. of fishery resources during the ice covered months. A second concern is the lack of information available on fishery resources which utilize the Yukon River Delta. This is considered as possibly the single most important ecosystem in the area and potentially the most vulnerable to disruption from either acute or chronic pollution problems. The deep water harbor of Port Clarence is also discussed as an area where further studies are needed to ensure proper planning and development of petroleum related activities in this area. (Sinha-OEIS)
W79-10034

INTERTIDAL BIOTA AND SUBTIDAL KELP COMMUNITIES OF THE KODIAK ISLAND AREA,
National Marine Fisheries Service, Auke Bay, AK. Northwest and Alaska Fisheries Center.
S. T. Zimmerman, J. L. Hanson, J. T. Fujioka, N. I. Calvin, and J. A. Gharrett.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 4: Biological Studies, p 316-508, March 1979. 114 fig, 29 tab, NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assesment Program, Boulder, CO.

Descriptors: *Baseline studies, *Water pollution effects, *Intertidal areas, *Biota, Kelps, Alaska, Resources development, Oil pollution, Environmental effects, Ecosystems, *Outer Continental Shelf, Petroleum development.

The overall objective of this study was to generally describe the distribution of littoral habitats and their associated biota by a combination of qualitative and quantitative observations. Because of the immense area covered and limited time, research has necessarily been extensive rather than intensive. The results generally reflect a 'survey' approach rather than the more prediction-oriented baseline or monitoring approaches which are often used to study areas of potential impact. As these littoral areas are more clearly delineated, research will be oriented toward monitoring changes in specific areas. This report summarizes the results of work in the Kodiak Island area and makes the information available before leasing decisions concerning that area are made. It was attempted to determine the distribution and percent occurrence of each type of major intertidal habitat and the assemblages of plants and animals that occur in these habitats. (Sinha-OEIS)
W79-10035

SORTING AND IDENTIFICATION OF INTERTIDAL SAMPLES,
National Marine Fisheries Service, Auke Bay, AK. Northwest and Alaska Fisheries Center.
J. Hanscom, D. Masiak, L. Shandelmeier, and G. Mueller.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 4: Biological Studies, p 509-573, March 1979. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO. 03-7-208-35135.

Descriptors: *Baseline studies, *Intertidal areas, *Systematics, *Alaska, Resources development, Environmental effects, Water pollution effects, Oil pollution, *Outer Continental Shelf, Petroleum development.

The stations and taxonomic problems encountered are summarized. The report is divided into three parts: Introduction, Station List and Taxonomic Section. The taxonomic section is further divided in a discussion of significant taxonomic problems, a species list, and the major references used for determination of the group. The taxonomic order is of convenience and not strictly hierarchical. Within the past three years well over 2,000 samples from approximately 80 localities were analyzed. The species composition, numbers of individuals, and in many cases wet and dry weights were determined. (Sinha-OEIS)
W79-10036

BASELINE STUDIES OF THE DEMERSAL RESOURCES OF THE EASTERN AND WESTERN GULF OF ALASKA SHELF AND SLOPE: A HISTORICAL REVIEW,
National Marine Fisheries Service, Seattle, WA. Northwest Fisheries Center.
W. T. Pereyra, and L. L. Ronholt.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 4: Biological Studies, p 574-669, March 1979. 1 fig, 29 tab, 11 ref, 2 append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Fisheries, *Statistics, *Baseline studies, Resources development, Water pollution effects, Oil pollution, Alaska, *Outer Continental Shelf, Gulf of Alaska, Petroleum development.

Included in this report is a description of the Survey Area, a 2,200 kilometer long arc in the Gulf of Alaska from Cape Spencer to Unimak Pass. The area contains 220,000 sq km of which 36% is in the 0-100 m depth zone, 48% in the 101-200 m depth zone, and 16% in the 201-400 m depth zone. The fish and invertebrate fauna are described. The fishes include 287 species belonging to 55 families. The invertebrate fauna is less well defined than fish fauna, but 13 commercially valuable species from 5 families are included. Comparisons between the results of resource abundance surveys in the Gulf of Alaska during 1961 and those in 1973-1976, indicate a statistically-significant increase in walleye pollock and Dover sole, and a decrease in Pacific ocean perch. Changes in catch per unit of effort (CPUE) from the 1960's to the 1970's were noted in each of 7 regions of the

Survey area, 3 depth zones, and 21 region-depth zones. Comparison between the 1960 and 1970 surveys was also made with reference to the distribution of biomass and rank order of prominent species in catch per sq km, both of which varied widely and suggested that dramatic changes have occurred over the years. (Sinha-OEIS)
W79-10037

BEAUFORT SEA ESTUARINE FISHERY STUDY,
Alaska Dept. of Fish and Game, Fairbanks. Div. of Sport Fish.
T. N. Bendock.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 4: Biological Studies, p 670-729, March 1979. 20 fig, 7 tab, 33 ref, append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO. 03-5-022-69.

Descriptors: *Baseline studies, *Fisheries, *Statistics, Water pollution effects, Oil pollution, Environmental effects, Alaska, *Outer Continental Shelf, Beaufort Sea, Petroleum development.

Petroleum exploration and development is rapidly increasing throughout the near shore areas of the Beaufort Sea. The demands by industry for construction material, gravel sources, fresh water and transportation avenues are substantial. Alterations of the physical environment resulting from water and gravel removal or the construction of roads, pads and causeways are imminent. Information on the biology of fish inhabiting these waters is necessary prior to evaluating the ultimate effects these activities have on the resource. The objectives of this study are to determine the distribution and relative abundance of the various species of fish inhabiting the near shore environs of the Beaufort Sea. By correlating important life history data with the knowledge of habitat needs, it is hoped to obtain base line information that can be used to direct the activities of people and industry in the proposed lease area. (Sinha-OEIS)
W79-10038

PRELIMINARY OBSERVATIONS ON THE DISTRIBUTION ABUNDANCE AND FOOD HABITS OF SOME NEARSHORE FISHES IN THE NORTHEASTERN GULF OF ALASKA,
Alaska Coastal Research, Homer.
R. J. Rosenthal.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 4: Biological Studies, p 730-804, March 1979. 6 fig, 21 tab, 19 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO.

Descriptors: *Fisheries, *Ecology, *Baseline studies, Statistics, Resources development, Water pollution effects, Oil pollution, Alaska, Estuarine fisheries, *Outer Continental shelf, Gulf of Alaska, Petroleum development.

The nearshore fishes and their respective habitats are most vulnerable to disturbances and perturbations associated with OCS development in the Gulf of Alaska. This report deals with the marine fishes of the northeastern Gulf of Alaska; more specifically, the teleostean fishes that typically inhabit the inshore zone from the intertidal/subtidal fringe out to depths of around -30 meters. Numerical data was collected on relative abundance and occurrence in the nearshore zone. In all, 1410 sq m of sea floor were examined quantitatively at Schooner Rock, Hinchinbrook Entrance and Danger Island, Montague Strait. Descriptions of major habitat types, and summer distributions of inshore pelagic and demersal species are presented in relation to substrate type, depth and vegetation. The emphasis was placed on the characteristic or conspicuous fishes that were believed to be either numerical or functional dominants in the nearshore system. (Sinha-OEIS)
W79-10039

LEVELS AND SOURCES OF CRITICAL TRACE METALS IN THE MARINE ENVIRONMENT,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
For primary bibliographic entry see Field 5B.
W79-10040

ACUTE TOXICITY OF HEAVY METALS,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
D. A. Craddock.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 52-81, March 1979. 4 tab, 40 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO.

Descriptors: *Toxicity, *Heavy metals, *Arctic, *Baseline studies, Resources development, Environmental studies, Water pollution, Water pollution sources, Cadmium, Nickel, Chromium, Lead, *Outer Continental Shelf, Petroleum development.

The toxic effects of heavy metals on marine species and more specifically of the effect on arctic and subarctic species were studied. The metals that were considered are four important metals associated with the production of petroleum: cadmium, chromium, nickel, and lead. Heavy metals in solution in seawater affect marine organisms mainly by adsorption. Adsorption may occur across the general body surfaces and through special structures such as gills, and in teleosts, which ingest seawater; absorption also takes place across the walls of the gut. Of the four metals under consideration, cadmium may remain in aerated seawater in the greatest concentrations, followed by nickel, lead and chromium. The concentration of a metal lethal to a marine organism depends on the metal and the organism. The toxicity of each of the four metals is treated briefly and a tabulation of reported toxicity by phyla for each is included. (Sinha-OEIS)
W79-10041

PATHOLOGY OF ARCTIC AND SUBARCTIC MARINE SPECIES AND EXPOSURE TO TRACE METALS ASSOCIATED WITH PETROLEUM,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
H. O. Hodgins, and J. W. Hawkes.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 82-92, March 1979. 37 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO.

Descriptors: *Pathology, *Metals, *Arctic, *Trace elements, Water pollution effects, Resources development, Baseline studies, Environmental effects, Cadmium, Chromium, Nickel, Lead, *Outer Continental Shelf, Petroleum development, Neoplasia, Immunosuppression, Cellular alterations.

There is little published information on pathological effects resulting from exposure of arctic and subarctic marine vertebrates and invertebrates to petroleum-associated trace metals (defined as primarily cadmium, chromium, nickel, and lead for this review). There is some published information, however, on pathological effects of these and other trace metals on other species, which by inference may be applicable to arctic animals. Examples of studies on trace metals implicated in neoplasia, immunosuppression, and in alterations in cellular and subcellular structure are presented. Whether similar effects actually do or can occur in arctic marine species mostly remains to be demonstrated. (Sinha-OEIS)
W79-10042

METABOLISM OF TRACE METALS: BIOACCUMULATION AND BIOTRANSFORMATION IN MARINE ORGANISMS,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
U. Varanasi, and D. C. Malins.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 93-224, March 1979. 33 fig, 38 tab, 111 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, Colorado.

Descriptors: *Heavy metals, *Baseline studies, *Metabolism, *Water pollution effects, Environmental effects, Resources development, Alaska, Cadmium, Lead, Chromium, Nickel, *Outer Continental Shelf, *Bioaccumulation, *Biotransformation, Petroleum development.

Studies with plankton support the view that these organisms are capable o concentrating cadmium from the marine environment to produce tissue levels many-fold greater than expoure levels. The toxic effects of lead include anemia, due to reactions of lead with hemoglobin and erythrocytes and to the tendency of this metal to interfere with porphyrin biosynthesis. Chromium has been detected in living organisms in only trace amounts and apparently has no known essential function in the physiology of either plants or animals. Chromium is toxic, especially to aquatic animals. Chromium exists in the +2, +3, +5, and +6 valence states, the trivalent and hexavalent species being more stable. Apparently, hexavalent chromium is assimilated more readily in organisms than trivalent chromium and is found to be at least a hundred times as toxic as the trivalent form. A few studies showed detectable levels of nickel in various marine animals obtained from relatively polluted areas indicating that nickel, in common with other trace metals, is accumulated to a much higher level than that existing in surrounding seawater. (Sinha-OEIS)
W79-10043

BEHAVIORAL AND PHYSIOLOGICAL EFFECTS INDUCED BY SUBLETHAL LEVELS OF HEAVY METALS,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
W. L. Reichert.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 225-240, March 1979. 1 fig, 5 tab, 20 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program.

Descriptors: *Baseline studies, *Heavy metals, *Water pollution effects, *Physiology, Resources development, Environmental effects, Alaska, Cadmium, Chromium, Lead, Nickel, *Outer Continental Shelf, *Sublethal effects, Petroleum development.

The physiological and behavioral effects of cadmium, chromium, lead and nickel on marine organisms under saline conditions are reviewed. The effects of metals on physiological responses of marine organisms are dependent on the temperature and salinity of the marine environment. In general, physiological effects of heavy metals increase with increasing temperature and decreasing salinity. The sparse literature on the physiological and behavioral effects of lead, cadmium, nickel and chromium presently provides insufficient background for balanced judgments relating to acceptable levels of these metals in the marine environment. (Sinha-OEIS)
W79-10044

GENERAL EFFECTS OF METALS ON THE ECOSYSTEM,
National Marine Fisheries Service, Seattle, WA. Northwest and Alaska Fisheries Center.
H. R. Sanborn.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 241-244, March 1979. 4 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program. Boulder, CO.

Descriptors: *Salt marshes, *Heavy metals, *Water pollution effects, Ecosystems, Resources development, Baseline studies, Environmental effects, *Outer Continental Shelf, Petroleum development.

Studies of the salt marsh have produced information on the cycling and budgets of metals in this ecosystem. Salt marsh sediments are reduced and act as sinks for metals. The metals are picked up by the roots of the marsh vegetation and incorporated in the above-ground tissue. Half of the annual standing crop of the marsh grass is transported to deeper water by tidal flushing and thus the incorporated metals are exported to deeper water. The literature reveals only a very limited view of the effects of chromium, nickel, lead, and cadmium on the ecosystem. The available information deals only with cycling and budgets with no information on the effects of the metals on the ecology of the animals and resuitant effects on populations and communities. (Sinha-OEIS)
W79-10045

MIGRATION OF BIRDS IN ALASKA MARINE HABITATS,
Fish and Wildlife Service, Anchorage, AK. Office of Biological Services and Coastal Ecosystems.
R. Gill, Jr., C. Handel, and M. Petersen.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 245-288, March 1979. 14 fig, 2 tab, 72 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO. 01-06-022-11437.

Descriptors: *Birds, *Migration, *Alaska, *Water pollution effects, *Oil pollution, Resources development, Environmental effects, Baseline studies, *Outer Continental Shelf, Petroleum development.

Existing data on the timing, routes, patterns and magnitudes of bird migrations in Alaskan OCS areas is summarized and these events are related to lease area activities. From the available data, timing and routes have been generalized for those species (alcids and seaducks) which have demonstrated a high susceptibility to oil contamination. In addition, migration for species (shorebirds) which have, to date, shown little susceptibility to oil contamination but which depend on habitats most likely to be adversely affected by nearshore oil related impacts is discussed. Alteration of avian food resources in littoral areas, especially those used for staging and/or molting by waterfowl as well as shorebirds, could affect entire populations with, as yet, unknown consequences to the species' population as a whole. As now understood, migration of most species occurs over and/or along inshore waters throughout coastal Alaska. (Sinha-OEIS)
W79-10046

AVIAN COMMUNITY ECOLOGY AT TWO SITES ON ESPENBERG PENINSULA IN KOTZEBUE SOUND, ALASKA,
Alaska Univ., Fairbanks. Inst. of Arctic Biology.
D. Schamel, D. Tracy, P. G. Mickelson, and A. Seguin.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 289-607, March 1979. 109 fig, 68 tab, 89 ref. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO. 03-5-022-56.

Descriptors: *Birds, *Ecology, *Oil pollution, *Water pollution effects, Alaska, Resources development, Environmental effects, Baseline studies, *Outer Continental Shelf, Petroleum development, Sand mining.

Cape Espenberg, a 1.5 km wide peninsula, jutting into the western edge of Kotzebue Sound in western Alaska, is comprised of a series of sand dune ridges, interspersed with numerous ponds and marshes. Prevailing winds are westerly during the summer and currents, which sweep nearshore at Espenberg, come from the west. Thus, large oil spills on Chukchi Sea waters north of the Bering Strait to Kotzebue Sound are likely to be deposited on the beaches of Cape Espenberg. Oil contamination of nearshore waters poses a threat to bird populations throughout the summer. Oil in leads in the ice may affect spring migrants which often concentrate there. Numerous birds rely upon marine food sources throughout the summer and would be subjected to oil contamination while foraging at sea or along the coast. Birds may also be indirectly affected by oil contamination through loss of food resources. The beach of Cape Espenberg is a likely site of sand extraction for petroleum development and related activities. Such activity during summer may produce sufficient turbidity to lower the feeding efficiency of birds near the site and downcurrent. Associated noise may lower the productivity of some nesting birds. Of prime concern, however, is the possibility that sand extraction may endanger the integrity of the Cape through erosion of the dunes. This might jeopardize the marsh habitat and its extremely high concentration of nesting waterbirds. (Sinha-OEIS)
W79-10047

AVIAN COMMUNITY ECOLOGY OF THE AKULIK-INGLUTALIK RIVER DELTA, NORTON BAY, ALASKA,
Alaska Univ., Fairbanks. Inst. of Arctic Biology.
G. F. Shields, and L. J. Peyton.
In: Environmental Assessment of the Alaskan Continental Shelf. Final Reports of Principal Investigators. Volume 5: Biological Studies, p 608-710, March 1979. 14 fig, 20 tab, 14 ref, 2 append. NOAA, Environmental Research Laboratories, Outer Continental Shelf Environmental Assessment Program, Boulder, CO. 03-5-022-56.

Descriptors: *Birds, *Ecology, *Oil pollution, Water pollution effects, Alaska, Environmental effects, Baseline studies, Resources development, *Outer Continental Shelf, Norton Sound, Petroleum development.

The Norton Sound area of western coastal Alaska has high potential for future petroleum related exploration and development activities. Avian species diversity in the area is relatively high but the majority of species are either spring or fall migrants most of which frequent the area in small numbers. Breeding species diversity is relatively low but nesting densities of some species in optimum habitats are moderate to high. The delta is used extensively by a number of waterfowl species and cranes in the spring and by a variety of waterfowl, shorebirds, and particularly cranes in the fall. Limited use of the delta is recommended particularly during spring and summer when potential nesters are affected greatly by human related activity. The importance of exposed near-shore mudflat and delta pond edges as feeding and staging areas primarily during spring and fall migrations are indicated. Finally caution is recommended regarding the use of all-terrain-vehicles especially in the spring when peak periods of native hunting on the delta may coincide with melt-off and the exposure of virgin tundra area. (Sinha-OEIS)
W79-10048

PROCEEDINGS OF A WORKSHOP ON SCIENTIFIC PROBLEMS RELATING TO OCEAN POLLUTION, ESTES PARK, COLORADO, JULY 10-14, 1978,
For primary bibliographic entry see Field 5A.
W79-10049

SYNTHETIC ORGANICS,
Environmental Research Lab., Gulf Breeze, FL.
P. A. Butler, R. Huggett, K. Macek, R. Reinert, and R. Risebrough.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 13-22, March 1979. 2 fig, 10 ref.

Descriptors: *Water pollution effects, *Organic compounds, Chemical wastes, Waste disposal, Chlorine, Synthetic organics, Ocean pollution.

Synthetic, organic chemicals present a 'text-book' example of the complexities involved between the antagonists - the pollutants, and the protagonists - the organisms they affect. The proposed research activities center about strategies to manage and manipulate the existing and forthcoming data that relate to both pollutant concentrations and their biological effects. The synthetic organic chemicals of concern contain chlorine atoms and are analyzed by gas chromatographic techniques. The development of a national, computerized network for accumulation and storage of information about spectral peaks on gas chromatograms is the primary research activity proposed relative to pollution from synthetic organics. (See also W79-10049) (Sinha-OEIs)
W79-10050

CHLORINATION PRODUCTS,
Rosenstiel School of Marine and Atmospheric Science, Miami, FL.
J. H. Carpenter, R. M. Bean, W. J. Blogoslawski, W. Davis, and R. L. Jolley.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 23-34, March 1979. 1 fig, 40 ref.

Descriptors: *Water pollution effects, *Chlorination, Industrial wastes, Bromine, Resources development, Outer Continental Shelf, Organic halocarbons, Ocean pollution.

The transfer of heat and some wastes to the marine system is producing another category of pollutants--the chlorination products. Chlorine is introduced to waste waters to disinfect them partially and to industrial waters to minimize slime and other types of biofouling. The chlorine interacts with the organic materials of seawater to produce chlorinated substances and with the bromate ion to produce bromine and hence brominated organic compounds. Among the compounds formed are chloroform and bromoform, both of which have carcinogenic and mutagenic properties. Scattered but increasing evidence indicates that undesirable impacts on marine organisms are associated with the use of these chlorination products. It is recommended that priority attention be given to problems concerning the composition and formation of the higher molecular weight organic halocarbons. (See also W79-10049) (Sinha-OEIS)
W79-10051

LITTER,
State Univ. of New York at Stony Brook. Marine Sciences Research Center.
For primary bibliographic entry see Field 5B.
W79-10053

ARTIFICIAL RADIONUCLIDES,
Battelle Pacific Northwest Labs., Richland, WA.
W. L. Templeton, F. Harrison, I. Ophel, J. Simpson, and N. Cutshall.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 69-103, March 1979. 9 tab, 42 ref.

Descriptors: *Radioisotopes, *Water pollution effects, *Water pollution sources, Monitoring, Environmental effects, Outer Continental Shelf, Biological effects, Ocean pollution, Ocean dumping.

Monitoring surveillance and research have provided the data that have enabled us to predict the distribution of radionuclides and their reactions in oceans, and to keep human exposure within the guidelines specified by international and federal bodies. Predictions have been validated by follow-up surveys. In terms of ecological effects, the consensus of the literature is that radionuclides are not likely to be significantly deleterious in populations of marine organisms at the dose rates estimated for the most contaminated environments. Although predictions are subject to revision in the light of new knowledge, there is no evidence that the past and present practices, or present policies for radioactive waste disposal in the oceans, have jeopardized humans or any marine species. Present knowledge on artificial radionuclides in the oceans have identified research needs in the following program areas: deep-ocean data base for subseabed emplacement of high-level radioactive wastes, long-term monitoring, chemistry of radioelements, marine sedimentation and remobilization, biological effects of chronic low-level exposures.

and monitoring of existing dump sites. (See also W79-10049) (Sinha-OEIS)
W79-10054

MICROORGANISMS,
Rhode Island Univ., Kingston.
V. J. Cabelli, A. F. Carlucci, C. D. Litchfield, T. G. Metcalf, and R. A. Murchelano.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 104-129, March 1979. 1 fig, 91 ref.

Descriptors: *Microorganisms, *Water pollution sources, *Monitoring, Water pollution effects, Ecosystems, Environmental effects, Resources development, Outer Continental Shelf, Ocean pollution.

Microorganisms released into coastal waters by discharges of human and lower animal wastes can jeopardize public health, since some of these organisms are agents of both human and faunal disease. Association, if not causality, between a form of pollution and some detrimental effect is strong enough in some instances to support criteria, guidelines, and standards as well as monitoring programs. There is a critical need for additional epidemiological or epizoological data, information associating pollution levels with human and faunal disease and the densities of the etiological agents involved, and research on methodology (especially as related to faunal disease). There is also a critical need for data concerning the roles of microorganisms in marine ecosystems and documenting any effects of pollutants on their activities. Recommendations for research and monitoring related to effects of microorganisms are listed. (See also W79-10049) (Sinha-OEIS)
W79-10055

TRACE METALS,
Southern California Coastal Water Research Project, El Segundo.
D. Young, C. K. Bertine, D. Brown, E. Crecelius, and J. Martin.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 130-152, March 1979. 3 fig, 65 ref.

Descriptors: *Metals, *Heavy metals, *Toxicity, *Water pollution effects, Ecosystems, Resources development, Environmental effects, Outer Continental Shelf, Ocean pollution.

During the past 5 years marine chemists have found that the concentrations of some trace metals in sea water are one or several orders of magnitude less than had previously been believed. The ability to sample sea water and to analyze it accurately for its trace metal without introducing contaminants has led to this discovery. As a consequence, human mobilization of metals such as lead, cadmium, copper, zinc, and chromium may be as great or even greater than movement of the metals in the major weathering cycles. Several areas of concern have developed: the impact on human health of the ingestion of seafoods enriched in trace metals, the toxicity of trace metals to marine organisms, and the disruption of ecosystems through trace-metal caused alterations of phytoplankton populations. (See also W79-10049) (Sinha-OEIS)
W79-10056

BIOSTIMULANTS,
National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
H. Curl, Jr., R. Dugdale, E. Jenne, D. P. Larsen, and R. Lasker.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 153-177, March 1979. 2 fig, 2 tab, 19 ref.

Descriptors: *Ecosystems, *Anaerobic conditions, *Aquatic plants, Water pollution effects, Resources development, Fishkills, *Biostimulants, Outer Continental Shelf, Ocean pollution, Anoxic conditions.

A continually increasing input to coastal waters of substances that enhance the growth of marine plants has altered marine ecosystems, usually in an undesirable way. These biostimulants, which include compounds of nitrogen, phosphorus, silicon, and metals, as well as dissolved organics, are introduced primarily in sewer outfalls. Perhaps their most dramatic effects are alterations in the composition of the food chain base and increases in plant population. Small microscopic plants, the diatoms which support large fish populations, are displaced by flagellates (marine weeds), poor foods for many of these grazers. The increased plant life can result in excessive oxygen consumption in the waters, leading to anoxic conditions, a situation that has been reported to result in fish kills, often of commercially important species. Anoxic conditions also discolor and cause unpleasant odors in waters and render them unpleasant for aesthetic and recreational uses. The primary research problem is to distinguish between natural and anthropogenic biostimulus to coastal ecosystems and to assess the magnitude of each. (See also W79-10049) (Sinha-OEIS)
W79-10057

FOSSIL FUEL COMPOUNDS,
Rhode Island Univ., Kingston. Graduate School of Oceanography.
J. G. Quinn, J. N. Butler, J. W. Farrington, D. C. Gordon, Jr., and J. L. Laseter.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 178-203, March 1979. 1 fig, 2 tab, 78 ref.

Descriptors: *Fossil fuels, *Water pollution effects, Resources development, Environmental effects, *Outer Continental Shelf, Biogeochemistry, Petroleum.

Petroleum compounds and their degradation products are the main components of this group of pollutants. Petroleum usage is predicted to decrease substantially in the next 30 years or so; simultaneously, use of coal and oil shale will increase as energy sources and feedstocks for the production of chemicals. Coal gasification and liquefaction, shale processing, and combustion and transport introduce many of the same compounds into the environment that petroleum does. Preventing significant adverse impact on humans and the environment will require substantial knowledge of the biogeochemistry and effects of fossil fuel compounds and their reaction products. The main problems that must be investigated to obtain that knowledge are described. (See also W79-10049) (Sinha-OEIS)
W79-10058

BIOLOGICAL EFFECTS - A GENERIC VIEW,
Woods Hole Oceanographic Institution, MA.
J. Teal, B. McCain, P. Jumars, J. Stegeman, and R. Howarth.
In: Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, held Estes Park, CO, July 10-14, 1978, p 204-219, March 1979. 17 ref.

Descriptors: *Water pollution effects, *Ecosystems, *Monitoring, Resources development, Environmental effects, Ecology, *Outer Continental Shelf, Biological effects, Ocean pollution.

With careful management the oceans can continue to supply us with fish, shellfish, other food or natural products, petroleum, and minerals. But pollution and inadequate care in preventing potential conflicts among competing resource uses can jeopardize our renewable marine resources and disrupt human societies. It is proposed that long-term studies of the natural variation in unpolluted marine ecosystems be initiated so it can be determined what types of changes are normal. Complementing these ecological studies would be investigations involving the manipulation of small ecosystems by introducing pollutants, followed by studies of their effect. Finally the proposed research programs must be accompanied with surveillance programs to monitor pollutant levels at given sites during exteneded time periods. (See also W79-10049) (Sinha-OEIS)
W79-10059

5D. Waste Treatment Processes

DISINFECTION OF WATER: PROS AND CONS,
National Inst. for Water Research, Pretoria (South Africa).
W. O. K. Grabow.
Water S.A., Vol. 5, No. 2, p 98-105, 1979. 83 ref.

Descriptors: *Water purification, *Chlorination, *Disinfection, Microorganisms, E. coli, Sewage bacteria, Pathogenic bacteria, Viruses, Water quality control, Potable water, Chlorine, Ozone, Ultraviolet radiation, Bromine.

It is estimated that 500 million people each year are affected by incapacitating water-borne or water-associated diseases, and as many as 10 million die. A wide range of pathogenic micro-organisms are associated with the transmission of disease by water. Chlorine is the most widely used disinfectant today. It is used for disinfection of drinking water, decontamination of waste water effluents, the inhibition of fouling in electric powerplants, disinfection of equipment, treatment of swimming pools, and many other purposes. Advantages of chlorine are: (1) when properly used it can ensure complete inactivity of all micro-organisms, (2) it is the cheapest means of disinfection, and (3) it has a residual effect as chloramines also inactivate micro-organisms. However, the chlorination of partially purified water has serious implications. Many pathogenic micro-organisms, particularly viruses, often survive treatment. Also, chlorinated compounds that may be toxic, mutagenic, or carcinogenic are created. These disadvantages can be overcome by selected application of waste water chlorination, dechlorination of treated effluents, or by alternative methods of disinfection such as ozonation, chlorine dioxide, bromine and iodine, bromine chloride, ultraviolet radiation, ionizing radiation, silver, photodynamic oxidationn, and advanced tertiary treatment and waste water reclamation. (Seigler-IPA)
W79-09845

WASTEWATER TREATMENT WITH DESORBING OF AN ADSORBATE FROM AN ADSORBENT WITH A SOLVENT IN THE NEAR CRITICAL STATE,
Little (Arthur D.), Inc., Cambridge, MA. (Assignee).
M. Modell.
U.S. Patent No. 4,147,624, 14 p, 6 fig, 2 tab, 9 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 1, p 237-238, April 3, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, *Separation techniques, Industrial wastes, Organic wastes, Absorption, Condensation, *Regeneration, Polymeric adsorbents.

The object of this invention is to provide an improved process for wastewater purification using in particular polymeric adsorbents to remove organic impurities and an inert solvent in the form of a near critical liquid to extract absorbates from the adsorbent to regenerate it. The process comprises the steps of contacting the adsorbent with a near critical liquid which is a solvent for the adsorbate. The near critical liquid containing the dissolved adsorbate is then subjected to at least partial vaporization to form a vapor in which the adsorbate is substantially less soluble thereby making it possible to remove the adsorbate from the near critical liquid. The vapor is then condensed to restore it to the near critical liquid state wherein it is a solvent for the adsorbate so that it may be reused. The process is particularly well suited to the removal or organic materials such as color bodies, surfactants and biological materials from wastewaters. (Sinha-OEIS)
W79-09929

PROCESS AND APPARATUS FOR SEPARATING MATTER IN SUSPENSION IN A LIQUID,

Societe Anonyme d'Etudes de Recherches et de Productions d'Agents Chimiques, Paris (France). (Assignee).
G. M. Treyssac.
U.S. Patent No. 4,146,472, 5 p, 1 fig, 7 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1413, March 27, 1979.

Descriptors: *Patents, *Waste water treatment, *Industrial wastes, *Water pollution treatment, *Separation techniques, Flow, Flow regulation, Suspended solids, Bubbles, Equipment.

A process and a device for separating matter in suspension in a liquid, such as floccules in suspension in water, consists of treating this liquid with particles, particularly gaseous particles, which moving under the effect of gravity carry along the matter in suspension. The separation process is characterized in that it consists in causing the liquid to be treated and a fluid of the same density charged with the particles to circulate in two superimposed, distinct and parallel flows, so that the particles contained in the fluid pass through the liquid to be treated under the action of gravity. The flotation apparatus for implementing the process comprises a treatment chamber provided, at one of its ends, with an inlet for the liquid to be treated circulating without turbuluence and, at the other end, an outlet for the treated liquid. An inlet pipe for the treatment water under high compression charged with gas is placed at the lower part of the treatment chamber and is located below and in the neighborhood of the inlet for the liquid to be treated. An outlet pipe for the treatment water is placed at the lower part of the chamber, below and in the neighborhood of the outlet for the treated liquid. (Sinha-OEIS)
W79-09941

CLOSED SPIRAL PATH WASTE WATER TREATMENT SYSTEM,
Activox, Inc., New York. (Assignee).
P. I. Rongved.
U.S. Patent No. 4,146,478, 9 p, 7 fig, 15 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1415, March 27, 1979.

Descriptors: *Patents, *Waste water treatment, Water pollution treatment, Aeration, Activated sludge, Circulation, Aerobic conditions, Equipment.

A continuous waste water treatment system comprises a reservoir providing a single, closed, continuous, substantially horizontal path through at least two adjacent substantially concentric loops. Each of the loops have a beginning and an end. The reservoir is provided with waste water inlet means, treated liquid outlet means, and aeration and circulation means. The treated liquid outlet is connected to clarifying means which removes at least some of the sludge carried by the treated liquid and the sludge return is provided to return at least some of the removed sludge to the reservoir. (Sinha-OEIS)
W79-09947

WATER FACTORY 21 DESIGN AND OPERATING DATA,
Orange County Water District, Fountain Valley, CA.
D. G. Argo.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 602, Price codes: A07 in paper copy, A01 in microfiche. Final Report prepared for the Office of Water Research and Technology, July 1979. 131 p, 6 fig, 21 tab, 4 append. OWRT (7533) (1), 14-34-0001-7533.

Descriptors: *Advanced wastewater treatment, *Facilities, Biological treatment, *Water reuse, Orange County Water District(CA), Demineralization, Reverse osmosis, Design data, Costs.

Water Factory 21 is a 15-mgd advanced wastewater treatment plant designed to improve the quality of biologically treated municipal wastewater so that it can be injected into a seawater barrier system. Treatment processes include lime clarification, ammonia stripping, breakpoint chlorination, filtration, activated carbon adsorption, reverse osmosis demineralization, and final chlorination. Because of increased interest in the utilization of advanced wastewater processes such as demineralization, this study was initiated to evaluate the performance of a large scale reverse osmosis system. The 5-mgd reverse osmosis system was designed to remove 90% of the dissolved minerals from the treated wastewater while achieving an overall product water recovery of 85%. In addition, reverse osmosis has proved very effective in removing dissolved organics from reclaimed wastewater. The data collected show that the combined processes, including demineralization, provide for an overall COD reduction of greater than 95%, producing an effluent with a mean COD of less than 2.0 mg/l. Operation of the large scale reverse osmosis system has demonstrated its feasibility. Its on-line performance during the first year of operation has been greater than 90% while achieving 90% rejection of all salts. The cost of large scale reverse osmosis demineralization is $0.62/1000 gal., including a capital cost of $0.17/1000 gal and an operating cost of approximately $0.49/1000 gal.
W79-09961

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR - EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY: SUMMARY REPORT,
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 792, Price codes: A03 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, March 1976. 32 p, 2 tab, 6 fig.

Descriptors: *Waste water treatment, *Comprehensive planning, *Massachusetts, *Treatment facilities, *Water quality, *Waste water management, *Sludge management, Waste treatment, Waste water(Pollution), Waste water disposal, Regional analysis, Sewage districts, Pumping plants, Interceptor sewers, Sludge treatment, Organizations, Facilities, Financing, Boston(MA).

An inter-agency study group, organized in 1973, addressed methods for combatting pollution in the Boston Harbor-Eastern Massachusetts Metropolitan Area (EMMA) and vitally affecting the Metropolitan Sewer District (MSD). Its efforts are summarized in this volume. An introduction outlines the study's purpose and management. The existing situation in organization, facilities and finance is reviewed. Conclusions concerning population growth, sewer service, pollution abatement, system capacity and saltwater intrusion, satellite plant possibilities and service costing are drawn. Recommendations for the upgrading of plant capability and service for both the Deer Island and the Nut Island Treatment Plants are presented, followed by recommendations for two more plants in outlying areas. Pumping station and interceptor improvements and new construction are suggested. Costs are reviewed and financing methods recommended. The plan is broken into three phases and each phase reviewed with suggestions for completion. Finally the status and relationship of other related programs is assessed. These programs include sludge management, facilities planning and ongoing areawide waste treatment planning efforts. (See also W79-09993 thru W79-10011) (Zayac-NC)
W79-09992

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR - EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 1: PLANNING CRITERIA,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5G.
W79-09993

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 2: ENGINEERING CRITERIA,
Metcalf and Eddy, Inc., Boston, Mass.
For primary bibliographic entry see Field 8B.
W79-09994

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 4: WATER ORIENTED WASTEWATER DISPOSAL CONCEPTS,
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 798, Price codes: A04 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 53 p, 8 fig, 13 tab.

Descriptors: *Waste water treatment, *Waste water disposal, *Massachusetts, *Sludge treatment, *Regional analysis, *Treatment facilities, Waste treatment, Water reuse, River basins, Economics, Cost analysis, Waste water management, Boston(MA), Regional-municipal systems, Decentralization.

This is a part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. This volume investigates the water oriented wastewater utilization components of the EMMA Study's four proposed engineering concepts dealing with the planning area's anticipated wastewater management problems. Each concept is studied. The first looks at upgrading the systems within the present service area of the Deer and Nut Island wastewater treatment plants, with no expansion. The second concept proposes contraction of the service area tributary to the two treatment plants by creating five additional regional treatment systems. The third studies maximum expansion of the service areas, and the fourth looks at decentralization of wastewater treatment by construction of six more regional systems within the present service area of the Metropolitan District System. Considerations of the concepts include that they must be financially and technically feasible, existing facilities be incorporated into any regional systems, regionalization be sufficiently flexible to accomodate immediate needs economically, and receiving waters be considered in terms of both quality and flow requirements. A detailed discussion is presented of the four plans, with an overview of the plan noting advantages and disadvantages, followed by a discussion of those facilities that are located within the service area of the two plants, and the regional and municipal wastewater treatment systems that are located outside of this service area. An analysis of the feasibility of regionalization of sludge management using the fourth concept as a basis is presented. (See also W79-09992) (Zayac-NC)
W79-09997

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 5: LAND ORIENTED WASTEWATER UTILIZATION CONCEPTS,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5G.
W79-09998

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 9: MDC INTERCEPTOR AND PUMPING STATION ANALYSIS AND IMPROVEMENTS.
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 8B.
W79-10001

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLI-

TAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 10: DEER ISLAND WASTEWATER TREATMENT PLANT ANALYSIS AND IMPROVEMENTS.
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 804, Price codes: A05 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 62 p, 10 fig, 10 tab, 3 append.

Descriptors: *Massachusetts, *Cost analysis, *Waste water treatment, *Design criteria, *Treatment facilities, *Waste water management, *Waste water(Pollution), *Treatment plant design, Cost allocation, Operating costs, Maintenance costs, Aeration, Filtration, Sedimentation, Chlorination, Sewage treatment, Boston(MA), Primary facilities, Secondary facilities, Upgrading, Plant outfall, Pumping stations.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. This volume covers the basic design for upgrading the Deer Island plant and for providing those facilities that would be required to accomplish secondary treatment, including flows and costs. The existing facilities are described--plant operations, adequacy of existing facilities, the main pumping station, the preaeration facilities and the plant outfall system. More detail is then provided concerning the primary treatment facilities in order to discuss the need to provide additional primary treatment facilities to meet the 2000 year needs at the Deer Island Plant. Basic design criteria are reviewed, and information is provided on preaeration channels, primary sedimentation tanks, outfall systems, chlorination facilities and the effluent pumping station. Secondary treatment facilities are described. Alternative layouts are presented, including seven site options. Finally, suggestions for phased development of the recommended Deer Island Treatment Plant are made, with comparative costs presented for each phase, annual operating and maintenance costs and cost distribution. Appendices include a listing of principal equipment, a description of the main treatment plant, and an inventory. (See also W79-09992) (Zayac-NC)
W79-10002

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 11: NUT ISLAND WASTEWATER TREATMENT PLANT ANALYSIS AND IMPROVEMENTS.
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 805, Price codes: A04 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 51 p, 8 fig, 8 tab, 3 append.

Descriptors: *Massachusetts, *Waste water treatment, *Waste water(Pollution), *Treatment facilities, *Waste water management, Aeration, Filtration, Sewage treatment, Cost analysis, Construction costs, Operating costs, Maintenance costs, Pumping, Outfall sewers, Sedimentation, Sludge treatment, Boston(MA), Primary treatment, Secondary treatment.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. The purpose of this volume is to study and analyze the necessary improvements to the primary treatment facilities at the Nut Island Wastewater Treatment Plant, together with the work necessary to provide secondary treatment facilities. The existing plant and operations are described. The adequacy of individual facilities are checked. These include preliminary treatment, influent pumps, preaeration, primary sedimentation, sludge pumping, scum collection and chlorination facilities, the heating and electrical plants, and the outfall system. Sizing and basic design of the proposed secondary facilities are reviewed. Alternative arrangements are discussed, and the selected plan is described. It includes an additional 24.8 acres of fill on Nut Island for secondary treatment. The total estimated cost for facilities for secondary treatment is $137,236,000, excluding sludge management facilities. A plan for phased development is recommended and construction costs are presented for the proposed first and second phases, and for operation and maintenance costs. A cost distribution scheme is suggested. Appendices include a listing of principal equipment, a description of the main treatment plant, and an inventory. (See also W79-09992) (Zayac-NC)
W79-10003

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 15: RECOMMENDED PLAN AND IMPLEMENTATION PROGRAM,
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 814, Price codes: A07 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 144 p, 20 fig, 36 tab.

Descriptors: *Massachusetts, *Engineering structures, *Planning, *Water quality, *Waste water treatment, *Comprehensive planning, *Waste water management, *Implementation, *Facilities planning, Management, Sanitary engineering, Financing, Cost analysis, Cost allocation, Cost repayment, Construction costs, Operating costs, Maintenance costs, Sites, Design criteria, Sludge disposal, Sludge treatment, Treatment facilities, Boston(MA), Interceptors, Headworks, Pump stations, Primary treatment, Secondary treatment.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. This volume covers the recommended course of action for the study area--a decentralized system based on combined sewer regulation facilities. Combined sewer overflow regulation is studied through a review of policy, program recommendations, consideration of water quality needs and the recommended course of action. The satellite wastewater treatment plants are reviewed by looking at basic design criteria, site layouts, costs and sludge management techniques. Interceptor, pumping stations and headworks improvements to the existing system--including both the North and South Metropolitan Sewerage Systems--are analyzed by a discussion of interceptor relief requirements and headworks analysis and improvements. For both the Nut Island and Deer Island Treatment Plants, an inventory is provided of existing facilities, primary expansion, secondary extension, site requirements and phased development and costs. Construction staging and cost distribution is scrutinized more closely through a study of cost bases, annual operation and maintenance costs, and cost apportionment and allocation. Lastly, project financing and management is reviewed. (See also W79-09992) (Zayac-NC)
W79-10011

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. SUMMARY,
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 5G.
W79-10020

LOW COST METHODS OF TREATMENT OF AGRICULTURAL EFFLUENTS IN WARM CLIMATES,
Melbourne Water Science Labs. (Australia).
C. D. Parker.
Progress in Water Technology, Vol. 11, No. 1, p 267-278, 1978. 6 fig, 9 tab, 5 ref.

Descriptors: *Waste water treatment, *Water pollution treatment, Filtration, Effluents, *Public health, Water purification, Anaerobic conditions, Aerobic treatment, Oxidation lagoons, Trickle filters, Irrigation techniques, Water pollution control, Organic wastes, Environmental effects.

Described and illustrated in this paper are the applications of the low cost, low energy demanding processes of anaerobic and aerobic lagoons, oxidation ditches, trickling filters, anaerobic fermentations and irrigation (including flood irrigation, grass filtration, and spray irrigation) which can be applied in warm climatic areas to effectively control pollution from the organic type wastes of processing agricultural products such as fruit, milk, meat, vegetables, sugar, and wood products. Case histories are presented to illustrate the requisite conditions for the successful application of such processes under a variety of conditions and with consideration as to the public health aspects of each process. (Tickes-Arizona)
W79-10068

TREATMENT OF MERCURY CONTAMINATED AQUEOUS MEDIA,
Domtar Inc., Montreal (Quebec). (Assignee).
D. M. Findlay, and R. A. N. McLean.
U.S. Patent No. 4,147,626, 4 p, 4 tab, 6 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 1, p 238, April 3, 1979.

Descriptors: *Patents, *Waste water treatment, *Water pollution treatment, Industrial wastes, Mercury, Chemical precipitation, Hydrogen ion concentration, Chlor-alkali plants.

A technique removes substantially all the elemental mercury from a mercury containing aqueous media by adjusting the pH of the liquid to the range of 7-13, adding a polysulfide in an amount sufficient to combine with the elemental mercury to form a mercury sulfide which is precipitated and prevents the mercury from being resolubilized. The major source of mercury contaminated aqueous media from chlor-alkali plants is the effluent from the cell sewers which collected all of the water from floor washings, spills, purge streams, wash waters, and drainage from tank cleaning. (Sinha-OEIS)
W79-10069

CONSTRUCTION COSTS FOR MUNICIPAL WASTEWATER TREATMENT PLANTS: 1973-1977.
Dames and Moore, Denver, CO. Water Pollution Control Engineering Services.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-282 436, Price codes: A10 in paper copy, A01 in microfiche. EPA 430/9-77-013, January 1978. 211 p, 68 fig, 19 tab, 5 ref, 4 maps, 3 append.

Descriptors: *Waste water treatment, *Construction costs, *Bids, *Contract administration, *Estimating, *Analytical techniques, *Treatment facilities, Municipal wastes, Economics, Federal Water Pollution Control Act Amendments of 1972(PL 92-500), Contracts, Units costs, Forecasting, Public utilities, Regression analysis.

Construction bid data from 536 municipally owned wastewater treatment plants in all 10 regional offices of the U.S. Environmental Protection Agency were collected, categorized, and analyzed to provide reference for estimating future facility costs. All facilities sampled were funded after 1973 under PL 92-500, the Federal Water Pollution Control Act Amendments of 1972. The sample included 270 secondary plants and 267 advanced wastewater treatment (AWT) plants. Of the total, 225 are newly constructed plants, 38 are enlargements, 42 are upgrades, and 192 are both enlarged and upgraded facilities. Construction cost data are categorized according to three levels of detail: (1) first order--total plant construction costs; (2) second order--unit process construction costs and plan construction component costs; (3) third order--construction component costs of unit processes. Cost curves based on linear regression analysis are given which relate plant design flow for each order of data. Methods of estimating wastewater treatment plant costs based on first and second order cost curves are presented. All data used in the report are updated from the bid date to second quarter 1977 dollars using the EPA Wastewater Treatment Plant Cost indices. (Harris-Wisconsin)
W79-10080

5E. Ultimate Disposal Of Wastes

INFILTRATION OF LIQUID DAIRY MANURE INTO SOIL,
Pennsylvania State Univ., University Park. Dept. of Agricultural Engineering.
W. R. DeTar.
Transactions of the American Society of Agricultural Engineers, Vol. 22, No. 3, p 520-528 and 531, May-June 1979. 10 fig, 6 tab, 12 ref.

Descriptors: *Infiltration, *Waste disposal, *Farm wastes, Soils, Soil water, Soil sealants, Suspended solids, Permeability, Temperature, Basins, On-site investigations, Dairy industry, Soil science, Agriculture, Liquid dairy manure.

Basin infiltrometers and double-ring infiltrometers were used on the subsoil of four different soils to determine the infiltration rate of various concentrations of liquid dairy manure. Raw manure was diluted with water by ratios varying from 3:1 to 50:1. The liquid used for most of the tests did not contain the heavy fibers that tend to settle out immediately after mixing. Total solids, S sub t, were the primary measure of concentration, and steady-state infiltration with water, I sub w, was the indicator used for the type of soil. It was that the infiltration rate was proportional to I sub w to the (0.11) power/S sub t to the (0.67) power at one week. All tests were conducted in the field, and thus the results were subject to temperature effects. It was found that the infiltration rate decreased sharply with a rise in temperature, a result which is contrary to the normal behavior of water in soil. (Sims-ISWS)
W79-09965

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 4: WATER ORIENTED WASTEWATER DISPOSAL CONCEPTS,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-09997

PUMP-TYPE SLUDGE DREDGING APPARATUS,
Toa Harbor Works Co., Ltd., Tokyo (Japan). (Assignee).
M. Norisugi.
U.S. Patent No. 4,145,982, 11 p, 7 fig, 10 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 1, p 24, April 3, 1979.

Descriptors: *Patents, *Dredging, Channel improvement, Sludge, Water quality control, Turbidity, Equipment.

An improved pump-type sludge dredging apparatus includes a pump dredger having a first ladder, a sludge suction pump acting in cooperation with the ladder and pump dredger, a suction pipe, a second ladder, a suction device suspended from the second ladder and connected to the pump through a suction pipe, a rotator, a half-cylindrical sludge collector plate, a substantially inverted U-shaped body structure, a grating, movable vanes disposed outside the grating and gas collecting chambers. The object of this invention is to provide a dredging apparatus which is capable of performing the dredging operation without disturbing sludge, to minimize turbidity of water and to recover the gas producer from the sludge during the dredging operations. (Sinha-OEIS)
W79-10017

5F. Water Treatment and Quality Alteration

STUDIES ON NATURAL WATER COAGULANTS IN THE SUDAN, WITH SPECIAL REFERENCE TO MORINGA OLEIFERA SEEDS,
Sudan Medical Research Council, Khartoum.
S. A. A. Jahn, and H. Dirar.
Water S.A., Vol. 5, No. 2, p 90-97, April 1979. 4 fig, 2 tab, 20 ref.

Descriptors: *Coagulation, *Water purification, *Turbidity, *Seeds, Water quality, Water pollution treatment, Flocculation, Root systems, Optical properties, Colorimetry, Bacteria, Potable water.

The coagulating properties of powdered seeds of Moringa oleifera Lam., powdered root of Maerua pseudopetalosa (alum), and a mixture of Hibiscus sabdariffa L. seeds and soda were compared. Moringa seeds have long been used as a traditional water coagulant in rural areas of the Sudan where many people have to use muddy water from rivers or intermittent streams during the rainy seasons or turbid water from natural rain ponds and from artifical rain water catchments (hafirs) most of the year. Raw water for the experiments was obtained from two hafirs. The coagulating effects of the plant materials and alum were studied by a simplified 'jar test'. The coagulant was added in a concentration of 200 mg/l to cylinders containing 500 ml of muddy water. Stirring was carried out for exactly 5 min. using a glass rod. The degree of clarification was measured in terms of optical density with a colorimeter. When compared, the reaction rates and turbidity reduction for alum and Moringa seeds were very similar. Alum gave only a 1% greater reduction on initial turbidity. All three coagulants completed turbidity reduction in approximately 30 minutes, however turbidity reduction by Maerua was 4.4% less than with Moringa. The initial decrease of bacteria count in water treated with alum or Moringa was of the same order. However, with Moringa there was a secondary bacterial increase probably due to growth on the organic matter from the seeds. (Seigler-IPA)
W79-09844

USE OF MICROORGANISMS IN COMBINATION WITH SURFACE ACTIVE AGENTS TO SYNERGISTICALLY DISPERSE OIL SLICKS,
Exxon Research and Engineering Co., Florham Park, NJ. (Assignee).
For primary bibliographic entry see Field 5G.
W79-09930

MAGNETIC WATER CONDITIONER,
M. J. Brown.
U.S. Patent No. 4,146,479, 10 p, 13 fig, 9 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1415-1416, March 27, 1979.

Descriptors: *Patents, *Water treatment, *Water quality control, Demineralization, Cooling water, Scaling, Polarity, Magnets, Water conditioning.

A magnetic water conditioner has a hollow casing with an array of disc type cylindrical magnets arranged coaxially in the casing to provide an annular magnetic treatment zone in the space between the casing and the array. The magnets are polarized along diameters and have pole faces at their lateral surfaces, the magnets being rotatable about the axis of the array to various fixed positions that enable determination of the best field arrangement, all without any structural changes in the design of the conditioner. A plastic housing for the array provides parallel flow channels in the treatment zone, and which are all traversed by water fed to the zone by virtue of return passageways provided by molded end caps that also have openings which provide the inlet and outlet to the treatment zone. (Sinha-OEIS)
W79-09955

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR - EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY: SUMMARY REPORT,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-09992

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR - EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 1: PLANNING CRITERIA,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5G.
W79-09993

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 2: ENGINEERING CRITERIA,
Metcalf and Eddy, Inc., Boston, Mass.
For primary bibliographic entry see Field 8B.
W79-09994

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS MANAGEMENT AREA, EMMA STUDY, VOLUME 3B: STUDY OF WASTES FROM LARGE INDUSTRIES,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5B.
W79-09995

WASTEWATER ENGINEERING AND MANAGEMENT STUDY FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 3A: STUDY OF CERTAIN INDUSTRIAL WASTES.
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5B.
W79-09996

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 4: WATER ORIENTED WASTEWATER DISPOSAL CONCEPTS,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-09997

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 5: LAND ORIENTED WASTEWATER UTILIZATION CONCEPTS,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5G.
W79-09998

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 7: COMBINED SEWER OVERFLOW REGULATION,
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 840, Price codes: A08 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, November 1975. 155 p, 17 fig, 16 tab, 6 app.

Descriptors: *Waste water treatment, *Massachusetts, *Combined sewers, *Storm drains, *Storm runoff, *Hydrologic models, *Waste water management, Separated sewers, Engineering structures, Hydraulic structures, Conveyance structures, Storm water, Surface runoff, Unit hydrographs, Artificial storms, Simulation, Water quality management, Boston(MA), Urban hydrology.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. The purpose of this volume is to evaluate the combined sewer overflow problem on the Boston Harbor area in terms of quantifying the problem and identifying the direction that technical, environmental and economic analysis should take during detailed facilities planning. The combined sewer service within the MDC system, the extent of the overflow problem and its effects on the Boston Harbor receiving waters are described.

Analysis criteria used in the computer simulation to determine quality and quantity of overflows are presented. Existing overflow pollution control facilities and recent studies concerning such facilities are described. Alternatives and their related costs are developed, along with results of modeling the Boston Harbor water quality. Finally, a plan of action is proposed. Recommendations include: accelerating municipal planning for combined sewer control; accelerated municipal programs for operation and maintenance and construction to control or eliminate combined sewer discharges; giving appropriate authority to combined sewer correction in the planning process and construction grants program; clarifying the types of treatment required; alleviating pollution from urban runoff in designing combined sewer correction systems and by encouraging local land management practices and regulatory measures; and achieving consistent policies and design standards for combined sewer correction programs. (See also W79-09992) (Zayac-NC)
W79-09999

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 8: URBAN STORMWATER MANAGEMENT,
Army Engineer District, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 801, Price codes: A10 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 221 p, 55 fig, 24 tab.

Descriptors: *Waste water treatment, *Storm runoff, *Surface runoff, *Storm water, *Management, *Massachusetts, *Waste water management, Storm drains, Combined sewers, Drainage systems, Urban hydrology, Urban drainage, River basins, Storm structure, Artificial storms, Design storm, Planning, Runoff forecasting, Hydrographs, Water quality, Boston(MA).

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. The purpose of this volume is to prescribe cost-effective treatment measures for river basins and drainage areas in the EMMA area. A description is provided of the study area. Urban stormwater runoff is characterized by quality. The impact of this quality on receiving streams and collection and treatment facilities is described, then treatment objectives and methodology are outlined. Stormwater management plans for the study area include identification of urban stormwater runoff quality and quantity. Sources of pollution, its buildup and washoff are identified. This is incorporated into a mathematical model called 'STORM' which analyzes six components of the urban storm water cycle. The model is applied, using data on design storm rainfall, the antecedent dry period, land use and urban land surface characteristics. A methodology for stormwater management is described. Stormwater runoff-pollutograph relationships are highlighted. Alternatives for stormwater management are introduced and compared. Facilities are proposed, costs for management, capital, and operation and maintenance are summarized, and effects on receiving streams are described. Recommendations are made concerning further development of a stormwater management plan for Eastern Massachusetts. (See also W79-09992) (Zayac-NC)
W79-10000

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 9: MDC INTERCEPTOR AND PUMPING STATION ANALYSIS AND IMPROVEMENTS.
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 8B.
W79-10001

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 10: DEER ISLAND WASTEWATER TREATMENT PLANT ANALYSIS AND IMPROVEMENTS.
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-10002

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 11: NUT ISLAND WASTEWATER TREATMENT PLANT ANALYSIS AND IMPROVEMENTS.
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-10003

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS, EMMA STUDY, VOLUME 12: FINANCING AND MANAGEMENT, PARTS 1 AND 2,
Peat, Marwick, Mitchell and Co., Boston, MA.
For primary bibliographic entry see Field 6E.
W79-10004

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13: IMPACT ANALYSIS AND EVALUATION,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6G.
W79-10005

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13A: BIOLOGICAL IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6C.
W79-10006

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13B: SOCIO-ECONOMIC IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6B.
W79-10007

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13C: HYGIENIC IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 811, Price codes: A10 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 185 p, 29 fig, 34 tab, 50 ref.

Descriptors: *Massachusetts, *Waste water treatment, *Public health, *Environmental sanitation, *Water quality, *Waste water management, Waste water(Pollution), Management, Environmental effects, Environmental engineering, Human pathology, Human diseases, Legal aspects, Potable water, Sanitary engineering, Social aspects, Water pollution, Regional analysis, Watershed management, Sludge, Boston(MA).

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. The purpose of this volume is to determine the potential impacts which implementation of each alternative concept for wastewater management may have on the public health of the study area. Existing conditions are first evaluated. Each watershed is described: major point and non-point discharges are inventoried; water quality is assessed; and effects of pollution on public health are outlined. Potential hygienic impacts or changes that may be caused by implementation of each of the five alternative plans is assessed. This impact assessment is concerned not only with elimination or magnification of potential direct causes of physical disease, but also with changes in environmental conditions affecting the social and mental well-being of the inhabitants. From a hygienic standpoint, Concept 1 is recommended. To ensure hygienic acceptability of Concept 6, the Study's Recommended concept, further study should be undertaken on effects of advanced treatment facility discharge to two of the study area rivers. An addendum provides background information on both public health hazards found in wastewater and sludge, and the effectiveness of various wastewater and sludge treatment processes in the removal of hazardous substances. (See also W79-09992) (Zayac-NC)
W79-10008

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13D: VISUAL, CULTURAL AND DESIGN IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6B.
W79-10009

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 14: PUBLIC INVOLVEMENT,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6B.
W79-10010

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 15: RECOMMENDED PLAN AND IMPLEMENTATION PROGRAM,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-10011

PORTABLE WATER FILTER,
Teledyne Industries, Inc., Fort Collins, CO. (Assignee).
T. Grimm, and D. Ewald.
U.S. Patent No. 4,151,092, 10 p, 10 fig, 21 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 4, p 1393, April 24, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, *Water quality control, Filtration, Equipment, Taste, Odor, Portable equipment.

A portable water filter has a first container for holding a quantity of liquid to be treated. Mounted with respect to that container is a filter cartridge. A second container coupled to the cartridge is arranged to receive liquid pumped through the cartridge from the first container. Further included are means for manually pumping the liquid from the first container through the cartridge to the second container. In addition to its direct treatment of the liquid, the filtering material serves to remove undesired color, taste and odor induced by a disinfectant or bactericidal agent used with the system. (Sinha-OEIS)
W79-10077

5G. Water Quality Control

USER'S MANUAL FOR AGRICULTURAL RUNOFF MANAGEMENT (ARM) MODEL,
Hydrocomp Inc., Palo Alto, CA.
A. S. Donigian, and H. H. Davis.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-286 366, Price codes: A08 in paper copy, A01 in microfiche. Report No. EPA-600/3-78-080, August, 1978. 163 p, 16 fig, 25 tab, 33 ref, 3 append.

Descriptors: *Agricultural runoff, *Model studies, Computer models, Computer programs, Simulation analysis, Hydrologic budget, Sediment load, Pesticide residues, Nutrient removal.

This user manual provides detailed instructions and guidelines for using the Agricultural Runoff Management (ARM) Model, Versions I and II. The manual includes a brief general description of the ARM Model structure, operation, and components, but the primary purpose of this document is to supply information, or sources of information, to assist potential users in using, calibrating, and applying the ARM Model. Data requirements and sources, model input and output, and model parameters are described and discussed. Extensive guidelines are provided for parameter evaluation and model calibration for runoff, sediment, pesticide, and nutrient simulation. Sample input sequences and examples of model output are included to clarify the tables describing model input and output. The manual also has discussed computer requirements and methods of analysis of the continuous information provided by the model. This manual, when used with an understanding of the simulated processes and the model algorithms, can provide a sound basis for using the ARM Model in the analysis of agricultural nonpoint pollution problems and management practices. (Skogerboe-Colorado State)
W79-09904

USE OF MICROORGANISMS IN COMBINATION WITH SURFACE ACTIVE AGENTS TO SYNERGISTICALLY DISPERSE OIL SLICKS,
Exxon Research and Engineering Co., Florham Park, NJ. (Assignee).
R. R. Mohan, M. L. Robbins, A. I. Laskin, and L. A. Naslund.
U.S. Patent No. 4,146,470, 5 p, 9 tab, 7 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1412, March 27, 1979.

Descriptors: *Patents, *Oil pollution, *Oily water, Water pollution treatment, Water quality control, Microorganisms, Surfactants, Dispersion, Oil slicks.

It has been found that there is a synergistic effect, resulting in rapid and efficient dispersion of intact cohesive oil films or slicks, when specified microorganisms are used in combination with various chemical surfactants. The use of the synergistic mixtures allows for a marked reduction in the quantity of chemical surfactant or detergent necessary for dispersion, resulting in benefits in terms of both more favorable economics and less potential upset to the environment and the ecology. (Sinha-OEIS)
W79-09930

V-SHAPED OIL CONTAINMENT BOOM,
Bennett Pollution Controls Ltd., Vancouver (British Columbia). (Assignee).
J. W. Steen, J. Bennett, and I. McAllister.
U.S. Patent No. 4,146,344, 7 p, 7 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1373, March 27, 1979.

Descriptors: *Patents, *Oil pollution, *Oil spills, Water pollution control, Water quality control, Barriers, Floating, Containment, Oil booms.

An oil containment boom includes an elongated member of generally V-shaped cross-section, which is provided by a front wall section and a (preferably higher) read wall section, joined together along respective lower edges. Ballast means are provided for normally maintaining the elongated member upright with the joint between the front and rear walls at the bottom. Float means (preferably inflatable) are provided, which are placed between the front wall and the rear wall at a predetermined and preselected level above the joint. Drainage is provided within the front wall to permit polluted liquid which has rolled over the front wall and is trapped in the V-shaped member to escape to an area upstream of the front wall. A method of containing oil spills in ice infested water is also described. (Sinha-OEIS)
W79-09937

SYSTEM FOR COLLECTING OIL,
Yin-Lung Yang, Kangshan (Taiwan). (Assignee).
J. Y. Shyu.
U.S. Patent No. 4,146,482, 4 p, 3 fig, 11 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1416, March 27, 1979.

Descriptors: *Patents, *Oil pollution, *Oil spills, *Water quality control, Water pollution control, Barriers, Floating, Separation techniques, Containment, Gravity separation.

A dustpan-like collecting panel has two water proof floating tubes longitudinally mounted underneath the panel. This is for holding the panel floating on a sea surface inclined at a 15 to 20 degree angle. A 'U' shaped oil collecting tube having both ends sealed and several apertures cut into its top surface is mounted longitudinally underneath and abutted against the panel. An equal number of apertures are cut at the center line of the collecting panel to receive oil flowing from the apertures in the tube by the natural force of waves. A flexible pipe directs oil flow to a container where oil and water are separated automatically by gravity. (Sinha-OEIS)
W79-09969

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR - EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY: SUMMARY REPORT,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-09992

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR - EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 1: PLANNING CRITERIA,
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 793, Price codes: A14 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 386 p, 12 fig, 16 tab, 15 app.

Descriptors: *Massachusetts, *Model studies, *Projections, *Data collections, *Waste water management, *Comprehensive planning, *Planning criteria, *Sewerage projections, Analytical techniques, Population, Employment, Land use, Waste water(Pollution), Regional analysis, Methodology, Transportation, Water users, Calibrations, Data processing, Data transmission, Data storage and retrieval, Statistics, Industries, Boston(MA).

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. This report covers the development of planning data for projecting sewerage needs. Projections of population, employment and land use for 1990, 2000, 2020 and 2050 are made. These projections are used to estimate future wastewater contributions. Regional projections are presented for population and economic activity. The methodology used for each is discussed, and for population projections an analysis is presented of the procedure for quantifying inputs to the Cohort Survival Model. Projections by others are reviewed. Alternative allocations of population and employment are outlined. An overview of the EMPIRIC model is provided. Before calibration, data are assembled in five categories for population, employment, water and sewer use, land use, transportation, major centers and inter-district distances. Model application is then assessed: preliminary small-area allocations are made, preparations for small-area forecasts are completed, and results are presented. Finally alternatives are analyzed and the preferred plan is selected. Fifteen appendices include data, reports and plans used in the study. (See also W79-09992) (Zayac-NC)
W79-09993

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS MANAGEMENT AREA, EMMA STUDY, VOLUME 3B: STUDY OF WASTES FROM LARGE INDUSTRIES,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5B.
W79-09995

WASTEWATER ENGINEERING AND MANAGEMENT STUDY FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 3A: STUDY OF CERTAIN INDUSTRIAL WASTES.
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5B.
W79-09996

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 5: LAND ORIENTED WASTEWATER UTILIZATION CONCEPTS,
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 799, Price codes: A10 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 126 p, 19 fig, 29 tab, 2 app, 62 ref.

Descriptors: *Massachusetts, *Waste water disposal, *Waste water treatment, *Sludge treatment, *Costs, *Land treatment, *Waste water reclamation, *Land application, *Waste water management, *Sludge management, Land use, Waste water(Pollution), Regional analysis, Effluents, Conveyance structures, Sludge disposal, Capital costs, Construction costs, Cost analysis, Maintenance costs, Operating costs, Water reuse, Boston(MA), Rapid infiltration, Spray application, Collection facilities.

This is a part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. This volume studies use of land application methods to further treat and make use of conventionally treated wastewaters. Potential land application areas are identified and acreage needs are determined. Relevant land use and geological data are presented and effluent qualities reviewed. The proposed land wastewater management system is then reviewed. The design of the regional facilities and the projected conveyance system are discussed. A discussion of the management of effluent application is presented and storage and drainage and collection facilities are identified. An investigation of two methods for treatment of wastewater effluents--spray irrigation and rapid infiltration--is provided. A proposed sludge management plan is discussed. Capital costs and annual operation and maintenance costs are presented. Future requirements are assessed. Conclusions indicate that land application treatment is a viable alternative for the area. Recommendations include selecting one or two areas to be used for demonstration projects, such projects being sufficiently large to use reclaimed water in a recreational pond or for cultural application. Appendices present data on geology and soils and identification of potential land application sites. (See also W79-09992) (Zayac-NC)
W79-09998

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 7: COMBINED SEWER OVERFLOW REGULATION,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5F.
W79-09999

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 8: URBAN STORMWATER MANAGEMENT,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 5F.
W79-10000

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS, EMMA STUDY, VOLUME 12: FINANCING AND MANAGEMENT, PARTS 1 AND 2,
Peat, Marwick, Mitchell and Co., Boston, MA.
For primary bibliographic entry see Field 6E.
W79-10004

WASTEWATER MANAGEMENT PLAN. COLORADO RIVER AND TRIBUTARIES, TEXAS. SUMMARY,
Army Engineer District, Fort Worth, TX.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 843, Price codes: A03 in paper copy, A01 in microfiche. September 1973. 43 p, 9 tab, 2 fig.

Descriptors: *Water quality, *Water resources, *Waste water management, *Water management(Administrative), *Colorado River Basin(TX), Water quality standards, Water pollution treatment, Water pollution sources, Water treatment, Water reuse, Waste water reclamation, Sewage treatment, Geology, Texas, Planning, Water resources planning, Legal aspects, Waste water treatment.

This volume of the Colorado River Basin Wastewater Management Plan serves as a summary and review of problem areas, study objectives, suggested alternative methods of solutions, recommended plans, general environmental assessment of the plan, and a means of plan implementation. The physical features of the study area are described. The report identifies the major water quality problem as one of stream imbalance caused by disproportionate amounts of secondary effluent and quality degradation caused by mineral salts from natural sources and oilfield operations. Future water quality problems may result from septic tank failures and greater municipal discharges from increased population. Waste water treatment strategies are discussed, with a short summary of each strategy. These alternatives range from flow regulation to water reuse to various combinations of alternatives. An evaluation and comparison of advanced biological treatment systems and physical/chemical treatment systems is summarized. These systems are compared along lines of environmental quality, social impacts, effect on economic development, technology, institutional arrangements needed, and effect on resource conservation. The report discusses the implementation of the water quality plan including funding, institutional arrangements, and alternatives. Recommendations include reclassification of stream segments, mostly to effluent limiting; ranking of dischargers, using primarily BOD loadings and concentrations; permit requirements and compliance schedules; control of residual wastes through issuance of waste control orders; and construction of cost-effective public treatment facilities to meet objectives of P.L. 92-500. (Coan-NC)
W79-10020

APPARATUSES TO SEPARATE A MIXTURE OF LIQUIDS OF DIFFERENT SPECIFIC GRAVITIES, E.G. OIL AND WATER,
Machinefabriek Geurtsen Deventer N.V., Deventer (Netherlands). (Assignee).
A. A. Geurtsen.
U.S. Patent No. 4,147,629, 5 p, 1 fig, 2 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 1, p 239, April 3, 1979.

Descriptors: *Patents, *Oil pollution, *Water pollution control, *Separation techniques, Oily water, Specific gravity, Equipment.

An apparatus to separate a mixture of liquids of different specific gravities, e.g. oil and water is described in which in a settling vessel for liquids the buoyancy of the lighter liquid (oil) is used to move a diaphragm upwards to control the discharge of lighter liquid from the vessel. Means are provided to check temporarily or to slow down the downward movement of the diaphragm during the discharge. (Sinha-OEIS)
W79-10028

WATER CONTROL AND DISTRIBUTION APPARATUS,
Teledyne Industries, Inc., Fort Collins, CO. (Assignee).
S. Deines, G. L. Swiercinsky, and C. E. Engstrom.
U.S. Patent No. 4,147,631, 12 p, 15 fig, 17 ref; Official Gazette of the United States Patent Office, Vol. 981, No. 1, p 240, April 3, 1979.

Descriptors: *Patents, *Water treatment, *Water purification, *Filtration, Water quality control, Domestic water, Equipment.

A water filter apparatus includes a housing having a horizontally-disposed base unit. A coupling upstands from one end portion of the base unit and is attached to a faucet for receiving a supply of water. An outlet is directed downward from the base unit to discharge water received through the coupling. Also within the base unit is a valve that selectively permits the flow of water. Upstanding from another portion of the base unit is an inverted cup-shaped cap. An input fluid channel within the base unit leads from the valve to the chamber defined by the cap, and the valve selectively permits the flow of water through the coupling into the input channel and from that into the chamber. A filter cartridge within the cap has an inlet opening and an outlet opening so that water can flow through the cartridge and out of a spigot. A control regulates the flow of water and another regulates the flow rate. (Sinha-OEIS)
W79-10032

CENTRAL ARIZONA PROJECT RE:CAP, INFORMATION PACKET NO. 3.
Bureau of Reclamation, Phoenix, AZ.
Jan. 1979, 6 p. 12 fig.

Descriptors: *Water quality, *Water allocation(Policy), *Competing uses, *Equitable apportionment, *Central Arizona Project, Legal aspects, Administration, Water resources planning, Project planning, Municipal water, Industrial water, Irrigation water, Environmental effects, History, Arizona.

The allocation of Colorado River water, water quality in the Tucson area with the Central Arizona Project (CAP) and groundwater law are discussed in this third of a series of five summary information packets which describe the Central Arizona Project and related water and environmental issues. The three-tiered process by which Colorado River water is allocated is described although the eventual distribution of CAP water among Indian reservations, non-indian agriculturalists, and municipal and industrial users is still unresolved. Listed are a number of factors that will likely affect the final allocations, most of which focus upon how CAP water should be allocated between agricultural and municipal and industrial users. How the CAP will affect the quality of water in the Tucson area, which has long enjoyed relatively high quality water from its groundwater reservoirs, is analyzed here through a discussion of both Colorado River water quality which varies widely from year to year but is generally suitable for most uses, and water quality standards established by the U. S. Environmental Protection Agency, the Arizona water quality control council and the Arizona Department of Health Services. A brief history and discussion of Arizona groundwater legislation since 1864 is presented to illustrate that a multi-faceted approach is required in the formidable task of finding an equitable solution to groundwater allocations in the state. (See also W79-10060) (Tickes-Arizona)
W79-10062

6. WATER RESOURCES PLANNING

6A. Techniques Of Planning

A MATHEMATICAL MODEL OF STRATIFIED, BIDIRECTIONAL FLOW IN SHORT CULVERTS,
Utah State Univ., Logan. Dept. of Civil and Environmental Engineering.
For primary bibliographic entry see Field 2A.
W79-09835

WATER IN A DEVELOPING WORLD: THE MANAGEMENT OF A CRITICAL RESOURCE,
Westview Special Studies in Natural Resources and Energy Management, Westview Press, Boulder, Colorado, 1978. 282 p, 5 fig, 2 tab, 224 ref. A. E. Utton and L. A. Teclaff, Eds.

Descriptors: *Water resources, *Management, *Water law, *Institutions, *Programs, *Design, *Evaluation, *Developing countries, Natural resources, Water utilization, Energy, Water rights, Legislation, Planning, Environmental control, River basins, Economics, Alternatives, de la Plata River(Argentina and Brazil), Political process, Water demand.

The availability or lack of water places a limit on human well-being in most areas of the world; as population continues to expand, our resources will have to be used more wisely. This book focuses on the questions of how best to manage water resources in the face of growing demand. The contributors discuss trends in water use, methods of establishing effective and flexible water management institutions, the changing direction of water resource planning, and the need for harmonizing water use with environmental concerns. The conflict between Argentina and Brazil over the de la Plata River is presented as an example of the need for cooperation in international resource planning. Various water management problems encountered by developing countries are explored in the final section, with emphasis on institutional and human factors that affect economic growth. Covered also are water resources program design and evaluation to serve the political process; and notes and comments, including riparian rights for federal instream flow, New Mexico's national forests and the implied reservation doctrine, and brief comments on the United Nations Water Conference. (Bell-Graf--Cornell)
W79-09849

ENVIRONMENTAL QUALITY AND RIVER BASIN DEVELOPMENT: A MODEL FOR INTEGRATED ANALYSIS AND PLANNING,
Organization of American States, Washington, D.C., 1978. 107 p, 17 fig, 4 tab, 66 ref, 4 append.

Descriptors: *River basin development, *Environment, *Planning, *Methodology, *Rio Bermejo(Argentina), Evaluation, Projects, Regional analysis, Benefits, Costs, Social aspects, Economic impact, Environmental effects, Water resources, Mathematical models, Systems analysis.

During 1970-1975, the Program of Regional Development of the Organization of American States and the Government of Argentina conducted regional development studies of the Bermejo River Basin in Northern Argentina. Presented is their methodology of river basin planning to consider the environmental ramifications of development in the basin. Included are comments on the relationship between environment, development, and river

basin planning. It is recommended that: (1) an environmental quality objective be included in the planning exercise; (2) environmental concerns receive explicit consideration; (3) the dynamics and interactions affecting the system be considered; that (4) interdisciplinary teams be involved; (5) the planning effort be closely coordinated with other planning entities having interest in the area; (6) the public participate; (7) alternatives be formulated, including some that do not foreclose other potential development options; (8) the adverse and beneficial inputs of proposed alternatives be assigned economic values where possible; and (9) the inputs be displayed for use by decision makers. It is suggested that environmental concerns are best cared for through integrated planning; a river basin planning methodology based on systems analysis is outlined. Presented is a model for the evaluation and display of environmental impacts which may be used at early planning stages. Compared is the methodology used in the Rio Bermejo investigations to that suggested by the pilot study. (Bell-Graf--Cornell)
W79-09850

REGULATION MODEL OF THE LAKE VELENCE RESERVOIR SYSTEM,
Technical Univ. of Budapest (Hungary). Dept. of Water Management.
K. Koris, and B. Nagy.
Journal of Hydrological Sciences, Vol. 5, No. 1, p 45-52, 1978. 2 fig, 19 ref.

Descriptors: *Lakes, *Regulation, *Reservoirs, *Recreation, *Water levels, *Optimization, *Loss minimization, *Stochastic processes, *Chance-constrained quadratic programming, Estimating, Mathematical models, Damages, Reservoir operation, Reservoir releases, Scheduling, Equations, Monthly, Continuity equation, Water supply, Planning, Water allocation(Policy), Lake Velence(Hungary).

This paper analyzes a water resources system in Hungary consisting of Lake Velence and two upstream reservoirs, the system's objective being to ensure optimum recreation conditions in the region surrounding the lake. The problem is to regulate the lake level to meet recreational demands. A chance-constrained stochastic quadratic programming model is utilized to estimate the magnitude of the damages accruing from the lake levels other than ideal (high and low), thereby minimizing the average value of the damages resulting from level fluctuations; the model minimizes losses and yields monthly releases for one year. (Bell-Graf--Cornell)
W79-09852

THE ROLE OF COMPUTERS IN TRANSFER OF WATER RESOURCE TECHNOLOGY,
New Mexico Inst. of Mining and Technology, Socorro.
V. P. Singh.
In: Water Knowledge Transfer, Vol. 1. Proceedings of the Second International Conference on Transfer of Water Resources Knowledge, June '77, Fort Collins. N.S. Grigg, et al., Eds., Water Resources Publications, Fort Collins, CO., 1978, p 540-556. 5 fig, 1 tab, 21 ref.

Descriptors: *Computers, *Water resources, *Technology, *Technology transfer, *Knowledge, Mathematical models, Systems analysis, Equations, Regions, Irrigation, Hydraulics, Rainfall-runoff relationships, Hydrology, Stanford watershed model.

The role of computers in the development of water resource technology is discussed and illustrated by citing specific real-world examples, including problems of irrigation hydraulics and of rainfall-runoff. Ramifications of computer technology in the transfer of water resources technology within a region and from one region to another are reviewed. The problems ordinarily experienced in such a transfer are identified. In conclusion, given propitious economical, political and sociological climate, transfer of technology from one region to another is not an impossible task, even though technical difficulties may be formidable. Computers can close or widen the technological gap between the regions, depending upon the above climate. (Bell-Graf--Cornell)
W79-09853

PROBABILISTIC WATER QUALITY CONTROL POLICIES,
Asian Inst. of Tech., Bangkok (Thailand).
B. N. Lohani, and N. C. Thanh.
Journal of the Environmental Engineering Division, Proceedings of the American Society of Civil Engineers. Vol. 105, No. EE4, p 713-725, August 1979. 7 fig, 4 tab, 21 ref.

Descriptors: *Water quality control, *Water policy, *Probability, *Reliability, *Optimization, *Standards, *Dissolved oxygen, *Cost minimization, Biochemical oxygen demand, Mathematical models, Water management(Applied), Stochastic processes, Monthly, Operating costs, Constraints, Streamflow, Drainage basins, Systems analysis, Equations, Waste water removal, Taiwan.

A probabilistic programming model for regional water quality management in the Hsintien River in Taiwan is presented and found desirable for problems involving stochastic quantities. Four water quality management policies are studied for the requirement of maintaining a desired minimum dissolved oxygen level at all reaches of the river. In addition, a trade-off between the operating cost and degree of reliability for a target dissolved oxygen concentration at the Hsintien River has also been studied. Included is the monthly least-cost wastewater removal scheme for the Hsintien River, which shows significant savings in cost. (Bell-Graf--Cornell)
W79-09857

WATER QUALITY SAMPLING PROGRAMS IN RIVERS,
Melbourne Univ., Parkville (Australia). Centre for Environmental Studies.
For primary bibliographic entry see Field 5A.
W79-09859

MANAGEMENT OF WATER IN WESSEX,
Wessex Water Authority, Bristol (England).
J. K. Jackson.
Effluent and Water Treatment Journal, Vol. 17, No. 10, p 508-512, October 1977. 3 fig.

Descriptors: *Water management(Applied), *Wessex(Great Britain), *Planning, *Reorganization, Water supply, Water demand, Water resources, River basins, Benefits, Sewerage, Economics.

Reorganization of the water industry in England and Wales occurred on April 1, 1974, largely as a result of pressure from those within and without the industry who recognized the need for more effective management of water to meet increasing and frequently competing demands for water uses. Although for those commissioned with the task it is reassuring that the recent Government White Paper on the review of the industry supported the principle of river basin management as a central feature to be retained, it is nevertheless believed that some 3 years after reorganization there will be those who seek to learn of steps taken at regional level towards the prime aims of reorganization. Wessex Water Authority has introduced a fully multifunctional management system and this paper seeks to outline developing Wessex concepts of water management, to describe steps being taken with particular reference to water resources, and to emphasize the benefits deriving from corporate management over the whole field of the Authority's activity. (Bell-Graf--Cornell)
W79-09861

A COMPARATIVE CASE STUDY OF DYNAMIC MODELS FOR DO-BOD-ALGAE INTERACTION IN A FRESHWATER RIVER,
International Inst. for Applied Systems Analysis, Laxenburg (Austria).
For primary bibliographic entry see Field 5A.
W79-09862

ON THE MONETARY VALUE OF AN ECOLOGICAL RIVER QUALITY MODEL,
Nuclear Research Center, Karlsruhe (Germany, F.R.).
H. Stehfest.
Publication No. RR-78-1, International Institute for Applied Systems Analysis, Laxenburg, Austria, June 1978. 24 p, 7 fig, 11 ref.

Descriptors: *Water pollution control, *Waste water treatment, *Dynamic programming, *Decision making, *Optimization, *Cost minimization, *Streeter-Phelps model, *Rhine River(Fed Rep Germany), Economic efficiency, Monetary benefits, Mathematical models, Equations, Systems analysis, Measurement, Simulation analysis, Standards, Planning, Constraints, Probability, Ecological model.

Investigated by means of an example is the degree of complexity a water quality model should have if it is used for water quality management. A least-cost control problem for the Rhine River is solved for both a simple Streeter-Phelps model and a more complex ecological model. Using dynamic programming, the optimum distribution of waste water treatment effort on the river is derived such that standards of oxygen and nondegradable pollutants concentration are met. The differences between the optimal solutions (corresponding to the two models) are remarkable, but not as large as one might expect from the differences in the model structure. For the choice between the two optimum solutions, in which subjective aspects are encountered, a formal procedure is proposed which finds the solution with the lowest expected cost. (Bell-Graf--Cornell)
W79-09863

PROCEDURE FOR THE ECONOMICAL EVALUATION OF WATER NETWORKS' PARAMETERS,
Colorado State Univ., Fort Collins. Dept. of Agricultural and Chemical Engineering.
G. Oron, and D. Karmeli.
Water Resources Bulletin, Vol. 15, No. 4, p 1050-1060, August 1979. 3 fig, 14 ref.

Descriptors: *Networks, *Optimization, *Branch and bound method, *Geometric programming, *Water systems, *Cost minimization, Design, Constraints, Decision making, Pipes, Capital, Investment, Mixed-integer problems, Irrigation systems, Nonlinear equations, Systems analysis.

Water systems may be described by a set of mostly nonlinear equations, and the variables involved are either continuous or discrete. Generalized Geometric Programming is used herein to solve for least-cost values and the 'Branch and Bound' technique is used to express the variables in integer forms, as required for water systems. These two mathematical techniques are combined to produce an optimization method that solves nonlinear, mixed integer constrained problems. A solution for a water system problem is presented, wherein the problem is to determine the minimum cost pipe network variables for irrigation. (Bell-Graf--Cornell)
W79-09866

A MULTIOBJECTIVE MODEL FOR REGIONAL WATER QUALITY MANAGEMENT,
Asian Inst. of Tech., Bangkok (Thailand). Dept. of Environmental Engineering.
B. N. Lohani, and P. Adulbhan.
Water Resources Bulletin, Vol. 15, No. 4, p 1028-1038, August 1979. 1 fig, 6 tab, 12 ref.

Descriptors: *Water quality control, *Optimization, *Regional management, *Multiobjectives, *Cost minimization, *Goal programming, *Effluent standards, Dissolved oxygen, Biochemical oxygen demand, River basins, Constraints, Streams, Equations, Mathematical models, Systems analysis, Linear programming, Waste treatment.

Linear programming is the simplest of all the optimization techniques used in regional water quality management studies; but the technique can optimize only one goal. When there are multiple goals with the same or different priorities, goal programming is a useful decision-making tool. This article illustrates the application of goal programming to a

regional water quality management problem where the following two goals are considered: (1) minimize the total cost of waste treatment; and (2) maintain the water quality goals (dissolved oxygen) close to the minimum level stated in the stream standards. (Bell-Graf--Cornell)
W79-09867

MODELING WATER DISTRIBUTION IN SANTA CLARA COUNTY, CALIF.,
National Inst. for Water Research, Pretoria (South Africa).
For primary bibliographic entry see Field 4A.
W79-09877

USER'S MANUAL FOR AGRICULTURAL RUNOFF MANAGEMENT (ARM) MODEL,
Hydrocomp Inc., Palo Alto, CA.
For primary bibliographic entry see Field 5G.
W79-09904

HEURISTIC DECISION RULES FOR WATER RESOURCES PLANNING,
Kannert Graduate School of Management, Lafayette, IN.
V. Akileswaran, T. L. Morin, and W. L. Meier, Jr.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 578, Price codes: A12 in paper copy, A01 in microfiche. Purdue University Water Resources Research Center Technical Report No. 119. August 1979. 263 p, 6 fig, 3 tab, 195 ref, 5 append. OWRT B-086-IND(1).

Descriptors: *Planning, *Methodology, *Decision making, Multipurpose projects, *Optimization, *Heuristics.

For the practical field level many of the analytical techniques advocated for water resources planning and management are too sophisticated to be used. This report addresses and develops the significance and importance of heuristics applicable to field-level water planning and management activities. The analysis focuses primarily on the capacity expansion planning problem which is formulated as a combinatorial optimization problem. In order to justify theoretically that for such combinatorial problems 'good' exact solution techniques may never be found, and that at present heuristics provide the only means for treating many such difficult combinatorial problems, the concept of 'NP completeness' is introduced. A survey was made of relevant work and the various mathematical programming solution methodologies are critically reviewed. Most of these techniques require excessive amounts of computational and analytical resources, more than for most planning agencies. Thus, several new usable heuristics and relaxations are proposed. The development and analysis of the optimality of these heuristics is outlined. The heuristics are tested and their performance evaluated on data from a number of real-world problems. The heuristics are so simple to apply that they have been implemented on hand-held calculators for which programs are provided in the report.
W79-09962

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 9; MDC INTERCEPTOR AND PUMPING STATION ANALYSIS AND IMPROVEMENTS.
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 8B.
W79-10001

A LAND-USE PLANNING MODEL FOR COASTAL ZONE MANAGEMENT,
State Univ. of New York at Stony Brook. Coll. of Engineering and Applied Sciences.
E. Beltrami, and T. O. Carroll.
Coastal Zone Management Journal, Vol. 4, Nos. 1/2, p 83-96, January-February, 1978. 4 fig, 3 tab, 4 ref.

Descriptors: *Planning, *Land use, *Linear programming, *Mathematical models, *Water pollution sources, *Coastal zone management, *Nassau County(NY), *Suffolk County(NY), Water pollution, Water quality, Biochemical oxygen demand, Long Island(NY).

A model is presented for estimating the pollution concentrations in a coastal area resulting from aggregate impact of land use activity in areas adjacent to a shoreline. The methodology is intended to be useful to regional planners, and is based on a study conducted for the Long Island area. The model attempts to explain average, steady-state pollution concentrations by measuring emissions into water from industrial, residential, commercial and other land use activity in pounds per acre per year of BOD and nitrates; by measuring coastal impacts of these pollutants in parts per million (ppm) concentrations in coastal waters; and by assigning different 'transport' coefficients to these flows of emissions to represent their relative ease or difficulty in flowing into coastal waters. Model formulation was based upon the assignment of zones to the subject area and building in the plan for preservation of some land in each zone for future use. For the subject area, using measurement of pollutant concentration along the dimensions of existing and future planned land spatial configurations, land-use rearrangements allowed in the planning process, and predicted recharge activity and planned dredging projects for the area, BOD and nitrate pollutant transport coefficients were generated which yielded between 60-84 lb/year/acre of BOD runoff for higher density residential, industrial and commercial uses to 0-24 lb/year/acre for farm and open recreation uses. (Arnold-NC)
W79-10015

6B. Evaluation Process

WATER DEVELOPMENT IN WYOMING: A SURVEY OF RESIDENT ATTITUDES, 1971,
Wyoming Univ., Laramie. Water Resources Research Inst.
J. C. Parker, C. Phillips, and S. E. Ferguson.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-300 495, Price codes: A03 in paper copy, A01 in microfiche. Completion Report, (1979). 45 p, 10 fig, 4 tab, 2 append. OWRT A-004-WYO (1), 14-31-0001-3551.

Descriptors: *Social aspects, *Public opinion, *Attitudes, Water resources development, *Wyoming.

The attitudes of Wyoming residents toward water resource development and their priorities for water use were surveyed in 1971. The survey covered general priorities, specific trade-offs between various development options, and potential problems. The 560 individuals responding to the questionnaire represented a full range of occupations, educational backgrounds, and income levels; every county in the state was represented, including residents of communities of all sizes and of rural areas. Responses are presented and discussed by both absolute and relative frequency; they were also cross-tabulated by age, education, income level, occupation, and residence class size. Agricultural use is the concept of water development ranked most important by one-third of the residents surveyed; in a binary ordering of uses, agriculture was preferred to all other uses, recreation to all but agriculture, and municipal over industrial uses. Wyoming residents generally feel that the state's streams have 'some' pollution, and they ranked planning and development most important of the water problems that the state will face in the near future. Among the findings of a series of questions surveying public participation in the decision-making process, more than two-thirds of Wyoming residents belong to a group that is concerned in some way with water issues.
W79-09833

ANALYSIS OF INVESTMENTS IN TECHNOLOGY DEVELOPMENT AND RESOURCE CONSERVATION,
Princeton Univ., NJ. School of Engineering and Applied Science.
B. S. Verkhovsky, and M. Sniedovich.
Advances in Water Resources, Vol. 1, No. 3, p 131-139, March 1978. 2 fig, 20 ref, 2 append.

Descriptors: *Water resources, *Technology development, *Conservation, *Capital, *Investment, *Methodology, *Economic analysis, Decision making, Research, Optimization, Dynamic programming, Decomposition technique, Industries, Mathematical models, Constraints, Equations, Systems analysis, Algorithms, Resource allocation.

An optimization methodology is presented for the economic analysis of capital investments in research, technology development and water resources conservation. The role of technology development and resource conservation is directly related to the availability of resources. Mathematically speaking, the problem is one in which part of the control variables are investments on technologies related to the manufacturing of diverse products. The methodology enables the decision maker to distribute efficiently restricted amounts of capital and resources to the different manufacturing systems so as to achieve the most profitable combination of production levels. Using the so-called 'technology function,' the solution procedure consists of a combination of decomposition and dynamic programming. The specific technology functions are considered as examples and it is shown how analytical consideration can be incorporated in the solution procedure so as to reduce computational requirements. Possible extensions of the problem are discussed. (Bell-Graf--Cornell)
W79-09854

NATIONWIDE COST OF WET-WEATHER POLLUTION CONTROL,
Florida Univ., Gainesville.
J. P. Heaney, W. C. Huber, R. Field, and R. H. Sullivan.
Journal of the Water Pollution Control Federation, Vol. 51, No. 8, p 2043-2053, August 1979. 4 fig, 6 tab, 20 ref.

Descriptors: *Methodology, *Cost analysis, *Simulation analysis, *Water pollution control, *Isoquants, *Runoff, *Wet-weather pollution, Optimization, Storm water, Reservoir storage, Water treatment, Waste water treatment, Comparison, Equations, Mathematical models, Systems analysis.

A generalized method for evaluating the optimal mix of storage and treatment for any desired level of wet-weather pollutant control was developed. The final assessment results for the entire U.S. indicate that the initial capital investment for 25, 50, 75 and 85% biochemical oxygen demand control is $2,476 million, $7,391 million, $22,744 million, and $41,968 million based on 85% of present worth of total annual cost at an assumed interest rate of 8% over 20 years. Incremental costs for wet-weather control increase significantly because of the disproportionately larger control units needed to capture the less frequent, larger storms. The results indicate significantly lower control costs than reported in earlier studies. (Bell-Graf--Cornell)
W79-09858

CAN OFF-PEAK PUMPING CUT UTILITY POWER COSTS,
Montgomery (James M.), Inc., Pasadena, CA.
For primary bibliographic entry see Field 4A.
W79-09860

INCOME DISTRIBUTION IMPACTS OF A WATER DEVELOPMENT PROJECT--BOISE PROJECT, IDAHO, 1950-1970,
Idaho Univ., Moscow.
E. S. Boydstun, T. Nelson, and R. B. Long.
Water Resources Bulletin, Vol. 15, No. 4, p 1086-1095, August 1979. 2 fig, 4 tab, 7 ref.

Descriptors: *Water resources development, *Income distribution, *Idaho, *Effects, *Projects, *Income growth, Evaluation, Irrigation water, Water supply, Rural areas, Comparison, Western US, United States, Gini ratios, Average income, Lorenz curves.

Public investments in water resources development projects need continual examination in terms of economic, environmental, and social impacts. The results of an analysis of a water development project that supplies irrigation water in Idaho are discussed as to the impact on income distribution and income growth 44 to 64 years after the project was initiated. Gini ratios for the rural farm population of these counties were consistently lower than they were for the United States as a whole and for the state of Idaho. Additionally, income distribution tended to become more equitable over time in the water project counties. Rural farm population income growth rates were found to be similar to those for the nation as a whole. Some of the reasons for these results may be related to the tendency for income distribution to become more equitable as income increases and to the fact that average farm size is relatively small. (Bell-Graf--Cornell)
W79-09865

COMPARATIVE EVALUATION OF STATISTICAL METHODS FOR WATER SUPPLY FORECASTING,
Maryland Univ., College Park. Dept. of Civil Engineering.
For primary bibliographic entry see Field 2E.
W79-09870

AN ANALYTIC APPROACH TO SCHEDULING PIPE REPLACEMENT,
Howard (Charles) and Associates Ltd., Winnipeg (Manitoba).
U. Shamir, and C. D. D. Howard.
Journal of the American Water Works Association, Vol. 71, No. 5, p 248-258, May 1978. 11 fig, 1 tab, 4 ref, 2 append.

Descriptors: *Pipes, *Economic analysis, *Scheduling, *Forecasting, *Effects, *Costs, Failure rate, Cost data, Discount rate, Breaks, Repair, Replacement, Regression analysis, Equations, Systems analysis, Cost-benefit analysis, Timing.

A procedure is described that uses the history of main breaks to forecast how the number of breaks would change with time if the pipe were not replaced; a separate analysis predicts the failure rate of newly installed pipes. These forecasts are combined with cost data and a discount rate that accounts for inflation to determine the optimal replacement data. The article considers an analysis of break data, and an economic analysis and results are presented. The economic analysis uses the following basic components: (1) the forecasted number of breaks in future years in the existing pipe; (2) the forecasted number of breaks in the new pipe, as a function of the time from its installation; (3) the cost of repairing one break; (4) the cost of replacing the existing pipe with a new one; and (5) the discount rate which should be used in converting future expenditures into present value. The economic analysis developed herein is simple to calculate and can be programmed for a hand-held calculator. (Bell-Graf--Cornell)
W79-09879

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13: IMPACT ANALYSIS AND EVALUATION,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6G.
W79-10005

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13A: BIOLOGICAL IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6C.
W79-10006

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13B: SOCIO-ECONOMIC IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 810, Price codes: A10 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 214 p.

Descriptors: *Massachusetts, *Social aspects, *Social impact, *Economic impact, *Economics, *Waste water treatment, *Waste water management, Employment, Recreation, Economic justification, Costs, Capital costs, Cost analysis, Income, Land use, Agriculture, Forestry, Municipal finance, Recreation, Commerce, Pulp and paper industry, Textiles, Food processing industry, Boston(MA), Housing, Metals, Chemical industry.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. This volume analyzes socio-economic conditions for each of five proposed wastewater service concepts. Eight substantive areas are reviewed: housing; industrial activity; recreational opportunity; commercial activity; agriculture and forestry; municipal finance; and employment and income. Because so many of the treatment plants and interceptor networks proposed are common to all five concepts, differential impacts on local land use are not substantial. For land application, it was found that since most disposal sites are quite remote from existing and planned development centers, adverse impacts would be minimized. In relatively unsewered areas lying in rapid growth corridors, potential impact upon residential growth can be large; the new facilities could exercise a 'triggering' effect on future residential development. In areas experiencing less rapid growth, public health of existing residential areas is expected to be improved. Local zoning and other policies are recommended to minimize disruptions. Industry, recreational activity, commercial activities, agricultural output, and employment and income will all be affected by implementation of any of the five concepts. (See also W79-09992) (Zayac-NC)
W79-10007

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13D: VISUAL, CULTURAL AND DESIGN IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 812, Price codes: A12 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 275 p, 3 app.

Descriptors: *Waste water treatment, *Massachusetts, *Aesthetics, *Waste water management, *Impact analysis, *Visual-cultural impacts, *Design impacts, Social aspects, Methodology, Recreation, Sewer systems, Boston(MA), Open space, Landscapes, Development patterns.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. This volume identifies and assesses the potential visual, cultural and design impacts resulting from the implementation of any of the five regional concepts for wastewater treatment in the study area. The report recognizes that it will most likely raise more issues and questions than it will address and attempt to answer; the full value of this study is seen in its use in combination with other assessments as part of an overall screening and review process. Baseline conditions regarding development patterns, landscape character, open space and recreation, existing sewer systems, and concept proposals are first summarized. A methodology is presented and visual, cultural and design impacts for each concept are assessed. Conclusions, recommendations and comments by region and by site help formulate a preferred concept (Concept 2), and a selected concept (Concept 1 with recommended modifications). An appendix presents site-specific baseline data and matrix forms. (See also W79-09992) (Zayac-NC)
W79-10009

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 14: PUBLIC INVOLVEMENT,
Army Engineer District, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 813, Price codes: A09 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 181 p.

Descriptors: *Massachusetts, *Planning, *Waste water management, *Waste water treatment, *Methodology, *Public participation, Institutions, Coordination, Management, Programs, Social aspects, Water quality, Boston(MA), Citizens, Public involvement, Public meetings, Workshops, Media participation.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. This volume reviews open planning in the EMMA study. It evaluates how the state, EPA, the Corps of Engineers, the Metropolitan Area Planning Council and a Citizens' Committee have worked together in a wastewater management study. The effort to encourage public response to planning data and assumptions as well as five different concepts for wastewater management are outlined. The strategy for public involvement is first reviewed. Issues are enumerated and perspectives of the various involved entities described. Components of the program are analyzed--committees, public meetings, briefings and workshops, informal contacts, media and written materials. A chronological record of events and their relation to plan formulation is presented. Finally, the participants' views of the program are gleaned from comments by citizens' committees, letters, newspaper clippings and written statements received at the final meetings. (See also W79-09992) (Zayac-NC)
W79-10010

A COMPARISON OF EVALUATIONS OF FOUR IRRIGATION PROJECTS,
H. B. R. Beale.
Growth and Change, Vol. 9, No. 3, p 22-28, July, 1978. 5 tab.

Descriptors: *Benefit-cost analysis, *Project benefits, *Irrigation projects, *Water resources development, *Cost analysis, *Cost comparisons, *Feasibility studies, *Budget studies, Reservoirs, Water projects, Economics, Agriculture, Cost allocation, Econometrics, Project planning, Benefit-cost theory, Emery County(UT), Little Wood River(ID), Paonia(CO, Smith Fork(CO).

This article analyzes land value budget studies by citing an example of different cost evaluation techniques which could be applied to Bureau of Reclamation small reservoir projects. The four projects studied are Emergy County (UT), Little Wood River (ID), and Paonia and Smith Fork (CO). The author suggests that Bureau of Reclamation projects are often uneconomic and that the Bureau budget studies of such projects are not adequate. Two methods of evaluation of porject benefits are compared--the standard Bureau of Reclamation evaluation, which counts as benefits assessed value of land improvements and uses a higher interest rate of return; and the land valuation method, which does not assess land improvements as benefits and which calculates a lower, closer to present 'market' rate of return on project benefits. The author asserts that the latter method of evaluation is a more realistic one and, if used, would result in

far fewer such Bureau projects. Further, the standard Bureau evaluation method does not define key variables, such as benefit/cost and internal rate of return, precisely enough to give accurate estimates of them. Budget studies themselves are discussed in terms of their potential strengths (e.g., general consistency of direct benefit estimation) and weaknesses (e.g., use of too low an interest rate by the Bureau). (Arnold-NC)
W79-10019

THE ECONOMIC VALUE OF IRRIGATION WATER IN THE WESTERN UNITED STATES,
Texas A and M Univ., College Station. Dept. of Agricultural Economics and Rural Sociology.
B. R. Beattie, M. D. Frank, and R. D. Lacewell.
In: Legal, Institutional and Social Aspects of Irrigation and Drainage and Water Resources Planning and Management, Proceedings, ASCE Irrigation and Drainage Division and ASCE Water Resources Planning and Management Division Specialty Conference, Virginia Polytechnic Institute and State University, July 26-28, 1978. p 572-581, (1978) ASCE, New York. OWRT A-034-TEX(2).

Descriptors: Economics, *Irrigated agriculture, *Water values, Social values, Irrigation water.

This paper addresses several issues pertinent to the economics of western irrigated agriculture. Estimates of the marginal value of water for the major irrigated regions of the 17 contiguous western states are reported. The sensitivity of these values to changes in farm product prices and pumping costs is discussed. Several myths for assigning agricultural water a social value in excess of farmer's ability-to-pay are presented and dispelled. The paper concludes with some thoughts on the future viability of irrigated agriculture in the West.
W79-10023

CONSTRUCTION COSTS FOR MUNICIPAL WASTEWATER TREATMENT PLANTS: 1973-1977.
Dames and Moore, Denver, CO. Water Pollution Control Engineering Services.
For primary bibliographic entry see Field 5D.
W79-10080

6C. Cost Allocation, Cost Sharing, Pricing/Repayment

WHAT PRICE, REJECT HEAT,
Waterloo Univ. (Ontario). Dept. of Civil Engineering.
E. McBean, D. Haycock, and J. Gorrie.
Water Resources Bulletin, Vol. 15, No. 3, p 684-691, June 1979. 2 fig, 6 ref.

Descriptors: *Waste heat, *Greenhouses, *Pricing, *Energy, Estimating, Electric powerplants, Nuclear powerplants, Economic feasibility, Agriculture, Equations, Ontario(Canada), Water resources.

Increasing energy costs encourage more efficient energy use, including the better use of reject heat from electrical generating stations. Whether it pays to use this heat depends upon the price charged. There is to date no relevant market in Canada. This paper estimates lower and upper bounds on the price for reject heat as a first step in determining market feasibility. Price would then be resolved by negotiation. For the case study of Ontario greenhouses, the differential between lower and upper bounds is substantial. An assumed price resolution is consistent with profitable use of this reject heat by this greenhouse industry. (Bell-Graf--Cornell)
W79-09868

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13A: BIOLOGICAL IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 809, Price codes: A07 in paper copy, A0; in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 145 p, 17 fig, 21 tab.

Descriptors: *Massachusetts, *Environmental effects, *Biology, *Ecology, *Wastewater treatment, *Water quality, *Waste water management, Planning, Methodology, Environmental control, Data collections, Data transmission, Discharge(Water), Sediments, Biota, Water pollution, Boston(MA), Ocean discharges, Freshwater discharges, Land application, Impact assessment.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. This volume evaluates the impact of the proposed treatment facilities so that environmental consequences might be weighted against economic costs. Existing environmental data are evaluated and the need for further environmental data collections are identified. The subsequent charge is then to specify appropriate environmental criteria for use in evaluating the ecological impacts of the plans considered. Existing environmental data are first inventoried. An annotated bibliography is included. Water quality, sediments and biota are discussed. A summary of existing conditions by hydrological region is presented. Recommendations for further study are made, including new approaches, supplemental information and dissemination of available data. Assumptions and critical information concerning freshwater and ocean discharges, land application, and other important considerations are reviewed. An impact assessment methodology is introduced. Evaluation of wastewater management alternatives is presented for no action alternative and each of six plans considered. Finally, an evaluation of impacts of individual treatment facilities is made. (See also W79-09992) (Zayac-NC)
W79-10006

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 15: RECOMMENDED PLAN AND IMPLEMENTATION PROGRAM,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5D.
W79-10011

CENTRAL ARIZONA PROJECT RE:CAP, INFORMATION PACKET NO. 2.
Bureau of Reclamation, Phoenix, AZ.
Jan. 1979, 4 p. 4 fig.

Descriptors: *Water costs, *Cost allocation, *Construction costs, *Economic feasibility, *Central Arizona Project, Associated costs, Financing, Marketing, Project planning, Economic justification, Economic impact, History, Arizona.

The cost and economics of the Central Arizona Project (CAP) including the repayment of project costs and irrigation assistance are described in this second of a series of five summary information packets which describe the Central Arizona Project and related water supply and environmental issues. Repayment of the CAP costs to the Federal treasury, most of which will be paid over the life of the project through charges for the water delivered, involves the following factors: (1) How the repayment obligation is established, (2) who will repay the costs, (3) what the source of the revenues is, and (4) when the repayment will begin. A separate discussion of each of these factors is followed by a short history of the laws affecting the Bureau of Reclamation to document that the concepts and procedures outlined are not unique to the CAP but reflect water resource development policy since 1939. Some of the major factors considered in determining the economic viability of the CAP are discussed. (See also W79-10060) (Tickes-Arizona)
W79-10061

6E. Water Law and Institutions

WATER IN A DEVELOPING WORLD: THE MANAGEMENT OF A CRITICAL RESOURCE,
For primary bibliographic entry see Field 6A.
W79-09849

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS, EMMA STUDY, VOLUME 12: FINANCING AND MANAGEMENT, PARTS 1 AND 2,
Peat, Marwick, Mitchell and Co., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 806, Price codes: A10 in paper copy, A01 in microfiche, and AD-A036 807, Price codes: A14 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. Part 1 - 192 p, Part 2 - 291 p.

Descriptors: *Massachusetts, *Financing, *Management, *Institutions, *Planning, *Waste water treatment, *Waste water management, Administration, Organizations, Methodology, Cost analysis, Legislation, Financial feasibility, Bond issues, Institutional constraints, Treatment facilities, Government, Boston(MA), Communities, Funding, Agencies.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. These two volumes contain the study's management phase. The purpose is to evaluate and recommend modifications to the organizational and financial structures required to manage, fund and operate the recommended systems. Profiles of 12 metropolitan area sewerage agencies were prepared to serve as a benchmark against which to compare the delivery of wastewater treatment services. Current operations of MDC are reviewed, comparing its organizational structure against other metropolitan agencies. The influence of institutional and non-institutional pressures are examined. Barriers to goal attainment, and the implications of no change in the institutional network on the level and quality of wastewater services are described. A methodology for analyzing treatment facilities and costs is presented and alternative apportionment and allocation techniques are outlined; feasible alternatives are evaluated. The recommended organizational alternative is described as well as the legislative program required to implement the recommended structure. The approved methodology for apportioning and allocating costs is summarized and applied to historical and projected cost data to determine the relative cost impact on communities. Bonding alternatives are presented and a recommended structure is incorporated into the cost allocation to communities. (See also W79-09992) (Zayac-NC)
W79-10004

MARKET MODELS FOR WATER POLLUTION CONTROL: THEIR STRENGTHS AND WEAKNESSES,
S. Rose-Ackerman.
Public Policy, Vol. 25, No. 3, p 383-406, Summer 1977. 28 ref.

Descriptors: *Water quality, *Water pollution, *Water pollution control, *Regulation, *Pollution charges, *Federal Water Pollution Control Act, *Pollution rights, Water policy, Law enforcement, Discharge, Waste treatment, Legal aspects, Taxes, Environmental quality, Equity, Uncertainty, Market mechanisms, Public policy.

Two market schemes are examined for controlling water pollution--effluent charges and pollution rights. The Federal Water Pollution Control Act of 1972 is described with the changes needed to make it more effective. The major change is allowing for less costly alternatives to meet water quality goals. To enact more efficient market pricing solutions, the author describes necessary revisions of the 1972 Act. The market perspective is difficult to implement because any attempt to use monetary

incentives in pollution control must face squarely the inevitable difficulty of legislating a market into being when preconditions for this market do not exist. Problems arise in three major areas: (1) liability for pollution damage may be unclear; (2) the relationship between ambient water quality and waste discharge is not simple; and (3) the marginal cost of an additional recreational user of water is zero. The two alternatives for introducing market incentives are evaluated with regard to several criteria: time and uncertainty, emergencies, simple versus complex systems, municipalities and market schemes, collusion by dischargers, enforcement, and uniformity and market schemes. A critique of the overstated advantages of market mechanisms is offered along with general conclusions concerning their advantages. Pollution rights are preferred to charges because they: (1) assure the attainment of water quality thresholds; (2) minimize inequities; (3) provide a means of subsidizing municipalities without sacrificing efficiency; (4) permit growth without burdening existing dischargers; and (4) provide a way to handle emergencies. (Coan-NC)
W79-10016

WASTEWATER MANAGEMENT PLAN, COLORADO RIVER AND TRIBUTARIES, TEXAS. SUMMARY,
Army Engineer District, Fort Worth, TX.
For primary bibliographic entry see Field 5G.
W79-10020

6G. Ecologic Impact Of Water Development

ANTHROPOLOGICAL INVESTIGATIONS NEAR THE CREST OF THE CONTINENT, 1975-1978,
University of Southern Colorado, Pueblo. Dept. of Anthropology.
W. G. Buckles, B. L. Woodward, N. B. Buckles, K. E. Adams, and B. R. Miller.
Edited by Buckles, W. G., Volumes I, II, and III, November 1978. Prepared for the Bureau of Reclamation, Lower Missouri Region. 1139 p, 163 fig, 55 tab, 294 ref.

Descriptors: *Archeology, *History, *Colorado, Irrigation, Diversion, Environmental effects, Mining, Recreation, Geologic history, Dating, Stratigraphy, Time.

Archeological, historical, and paleontological resources in an area near the Continental Divide in Colorado relative to the Fryingpan-Arkansas Project were inventoried, evaluated, and mitigated. The project will divert water flow from the western slope of the Continental Divide to the eastern slope for irrigation, industrial use, and municipal use. Of the 259 sites studied, 132 had historical components. Approximately 10,000 years of prehistoric occupation are represented. Most sites have mixed components, but two sites had resources in unmixed contexts and were dated at AD. 1 - AD. 1000 and 4,200 years old respectively. Differences in solar radiation availability and other environmental and cultural variables were considered when analyzing patterns of historic site distribution, function, and other attributes. Probabilistic sampling was used to assess sampling strategies useful for other similar studies. Attributes of the sites were analyzed as patterns (locational, temporal, functional, and behavioral). To explain historic patterns and processes, syntheses of the systemic relations between industrial, environmental, site, behavorial, and other patterns were analyzed. (Seigler-IPA)
W79-09840

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13: IMPACT ANALYSIS AND EVALUATION,
Army Engineer District, Waltham, MA. New England Div.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 808, Price codes: A07 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 144 p, 10 fig, 7 app.

Descriptors: *Massachusetts, *Planning, *Evaluation, *Waste water management, *Impact analysis, Waste water treatment, Comprehensive planning, Project planning, Projections, Administration, Coordination, Decision making, Governments, Institutions, Legislation, Management, Programs, Regional developments, Social aspects, Alternative planning, Boston(MA), Public participation, Environmental impacts.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. This volume documents the Corps' impact assessment effort as part of the development of alternatives for the study area. Both beneficial and adverse aesthetic, biological, hygienic and socio-economic impacts resulting from the various proposed alternatives for wastewater management are considered. The first part of this report defines the basis for impact assessment in the planning process. Used is the Water Resources Council's Principles and Standards, which establishes a framework for formulation and evaluation of Federal water and related land resources projects. The report next shows the relationship between tasks performed by the study team and those specified in Principles and Standards. Discussed are: identification of goals and objectives, input of goals into the development of wastewater management alternatives; impact analysis; public participation; and requirements of Public Law 92-500. A summary of the various impact analyses and an evaluation of impacts in relation to both study and Federal goals and objectives is provided. Results of the impact analyses will be used in the final Environmental Impact Statement for the study's Recommended Plan. (See also W79-09992) (Zayac-NC)
W79-10005

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13B: SOCIO-ECONOMIC IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6B.
W79-10007

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13C: HYGIENIC IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 5F.
W79-10008

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 13D: VISUAL, CULTURAL AND DESIGN IMPACT ANALYSIS,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 6B.
W79-10009

CENTRAL ARIZONA PROJECT RE:CAP, INFORMATION PACKET NO. 5.
Bureau of Reclamation, Phoenix, AZ.
Feb. 1979, 6 p. 8 fig.

Descriptors: *Central Arizona Project, *Environmental effects, *Recreation facilities, *Wildlife conservation, Balance of nature, Environmental control, Wildlife management, Resources development, Project planning, National Environmental Policy Act, Arizona, Aqueducts.

The relationship of the Central Arizona Project (CAP) to the National Environmental Policy Act (NEPA), the Endangered Species Act, and the development and management of recreation facilities are described in this, the last in a series of five summary information packets which describe the Central Arizona Project and related water supply and environmental issues. CAP features for which individual statements or other NEPA compliance documents have been or will be prepared are the: (1) Granite Reef aqueduct, (2) Salt-Gila aqueduct, (3) Indian distribution system, (4) Tucson division, (5) regulatory storage division, (6) Buttes Dam and Reservoir, and (7) water allocation process. Each of these features or actions is discussed in terms of the status of the environmental process and the identified or anticipated major environmental concerns associated with each feature or action. The Endangered Species Act requires federal agencies to conduct a biological assessment on listed species in the projects area. Although there are presently no federally listed endangered species within the Tucson division study area, the desert tortoise and one species of plant, Cheilanthes pringlei, have both been proposed for listing. Three options for developing recreational facilities under the Federal Water Project Recreation Act enacted in 1965 are outlined. (See also W79-10060) (Tickes-Arizona)
W79-10064

RURAL WATER DEVELOPMENT IN ARID REGIONS,
Intermediate Technology Development Group, London (England).
P. H. Stern.
Progress in Water Technology, Vol. 11, No. 1, p 21-23, 1978. 1 tab, 4 ref.

Descriptors: *Water resources development, *Water supply development, *Area redevelopment, *Regional development, *Water supply, *Arid lands, Comprehensive planning, Social aspects, Water utilization, Pastoralism, Groundwater resources, Surface water resources, Water availability, Water requirements, Rural areas, Ethiopia.

The general characteristics of the arid regions of the world, including the very limited water resources, necessitate special adjustments for human habitation. The relationship between the pastoral communities in these harsh areas and the available surface and groundwater resources are discussed here in terms of water requirements and particular measures needed to meet them, particularly those relating to official failure to recognize the relationship between pastoralists and their herds and the impact of such relationships on the community's water needs. The examples cited from the Ogaden desert region of Ethiopia illustrate in microcosm the necessity of intermediate technology approaches to problems of water supplies in such situations. (Tickes-Arizona)
W79-10065

ASPECTS OF ENVIRONMENTAL HEALTH IMPACTS OF THE ASWAN HIGH DAM ON RURAL POPULATION IN EGYPT,
Michigan Univ., Ann Arbor. School of Public Health.
F. D. Miller, M. Hussein, K. H. Mancy, and M. S. Hilbert.
Progress in Water Technology, Vol. 11, No. 1/2, p 173-180, 1978. 3 fig, 2 tab, 33 ref.

Descriptors: *Human diseases, *Environmental effects, *Public health, *Trematodes, Epidemiology, Water pollution effects, Dam construction, Schistomiasis, Regional development, Egypt, Aswan High Dam.

The widespread speculation that schistosomiasis, a disease which has long been a health problem in Egypt, would be greatly increased as a result of the construction of the Aswan High Dam or the related expansion of irrigation is examined here by means of an environmental and epidemiological survey of 15,329 rural Egyptians selected from the three major geographical regions of the Nile Valley and from the resettled Nubian population. Estimates based upon these and previous survey findings suggest that although a steady decline in the prevalence of this disease is clearly indicated since the 1930s, a minimum of 6.9 million Egyp-

tians are infected with either S. mansoni or S. haematobium or both, with the prevalence of infection being highest in the Nile Delta and decreasing from north to south. It is concluded, however, that there is sufficient historical and current data to firmly disregard any role of the Aswan High Dam in causing an increase in Schistosomiasis in rural Egypt. (Tickes-Arizona)
W79-10066

7. RESOURCES DATA

7B. Data Acquisition

PROCEEDINGS OF THE SYMPOSIUM ON THE RECOVERY OF INDICATOR ORGANISMS EMPLOYING MEMBRANE FILTERS,
Available from the National Technical Information Service, Springfield, VA 22161 as PB-273 587, Price codes: A10 in paper copy, A01 in microfiche. Held at the meeting of the American Society for Testing and Materials, Committee D-19 on Water, January 20-21, 1975, Fort Lauderdale, Florida. Report EPA-600/9-77-024, September 1977. 200 p, 1 append.

Descriptors: *Membranes, *Membrane processes, *Filters, *Bioindicators, *Coliforms, Analytical techniques, Testing procedures, Laboratory tests, Testing, Water analysis, Waste water treatment, Sewage bacteria, Municipal wastes, Industrial wastes, Design standards.

Topics discussed at the Symposium are categorized under the subjects of general papers, stressed/injured cells and observed effects on membrane filter recovery, comparisons of membrane filter lots and brands, and answers to apparent low recoveries. Problems associated with the use of membrane filters for water and waste water analyses and the recovery of bacterial indicators are most pronounced in fecal coliform tests. Media, transport kinetics, physical and chemical properties of membranes, membrane sterilization techniques, incubation temperatures, comparative methodologies, and proposed ASTM standards for evaluations of membranes are discussed. Two-step incubations, enrichment methods, and modifications for membrane filter structures are some of the resulting suggestions for improving indicator recovery. Standardization of testing procedures is also discussed. (See also W79-09882 thru W79-09900) (Lisk-FRC)
W79-09881

THE MEMBRANE FILTER DILEMMA,
Environmental Monitoring and Support Lab., Cincinnati, OH.
R. H. Bordner.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p. 8-11, 1977. 6 ref.

Descriptors: *Membrane processes, *Filtration, *Bioindicators, *Testing procedures, *Membranes, Specifications, Materials, Testing, Water quality control, Water quality standards, Materials testing, Waste water treatment.

Problems associated with the recovery of indicator organisms from water and waste water and requirements for improving membrane filter (MF) procedures are reviewed. The objectives of Symposium regarding MF technology are also listed. The utilization of MF processes in water quality control and in microbiological analyses is discussed and water and waste water standards and criteria are reviewed. Recent enforcement legislation and the importance of quality assurance methods are discussed. The American Society for Testing and Materials has developed preliminary test procedures for evaluating membrane filters and recovery of indicator organisms. (See also W79-09881) (Lisk-FRC)
W79-09882

PERFORMANCE VARIABILITY OF MEMBRANE FILTER PROCEDURES,
National Environmental Research Center, Cincinnati, OH. Water Supply Research Lab.
E. E. Geldreich.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 12-19, 1977. 51 ref.

Descriptors: *Membrane processes, *Filtration, *Performance, *Fabrication, *Pores, Porosity, Materials, Water analysis, Bioindicators, Waste identification.

Variabilities in the performance of membrane filter processes may be attributed to variations in the manufacture, absorbent pad impurities, sterilization procedures, media inconsistencies, and improper performance of membrane filter process applications to water analyses. The historical development of membrane filters is reviewed. Pores should be uniformly distributed on the membrane filter and should have diameters of 0.45 micron; pores larger than 0.7 micron will not retain indicator organism groups. Filter porosity of 0.22 micron permits complete bacterial separation from liquids. Other parameters discussed regarding membrane filters include the grid ink properties, physical structure of the membrane, chemical composition, and sterilization techniques. Variabilities in the membrane filter tests and special membrane filter application considerations are also reviewed. (See also W79-09881) (Lisk-FRC)
W79-09883

QUALITY CONTROL OF MEMBRANE FILTER MEDIA,
BioQuest, Cockeysville, MD.
D. A. Power.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 20-28, 1977. 10 ref.

Descriptors: *Membranes, *Filters, *Fabrication, *Materials testing, *Quality control, Physical properties, Chemical properties, Performance, Bioindicators, Testing procedures, Cultures, Water quality.

Considerations and factors in the quality control of membrane filter media by both the manufacturer and the user are reviewed. Manufacturers investigate the raw materials incorporated into the dehydrated media prior to formulation of membrane filter media. The dehydrated products are also checked for suitable physical and chemical properties, microbial contamination, and growth support; dehydrated materials are also subjected to performance testing with specific media. Quality control procedures and considerations for the user in the laboratory include: the age of the product, storage conditions, accurate weighing, distilled water quality, clean instruments, mixing and solution factors, controlled heating, accurate pH calculations, supplement quality, and appropriate testing with stabilized test cultures. Monitoring the appearance, pH, sterility, and membrane performance with selected test organisms is also recommended for the resulting media. A discussion of the report is also included. (See also W79-09881) (Lisk-FRC)
W79-09884

STATISTICAL INTERPRETATION OF MEMBRANE FILTER BACTERIA COUNTS,
Millipore Corp., Bedford, MA.
K. J. Sladek, C. F. Frith, and R. A. Cotton.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 26-33, 1977. 2 fig, 3 tab, 4 ref.

Descriptors: *Coliforms, *Membranes, *Analytical techniques, *Statistical models, *Sewage bacteria, Statistical methods, Design criteria, Testing procedures, Water quality analysis, Waste water treatment.

The various methods and statistical designs for enumerating bacteria by membrane filters are reviewed. The use of large numbers of replicates can increase the precision of mean counts and in fecal coliform tests, the use of water samples stabilized by dilution in phosphate buffered peptone can result in large numbers of replicates. Precision of the counts may also be increased by reducing the scatter among replicates. Even in well mixed samples, variations in bacterial density produce a lower limit of scatter which is predictable as the theoretical minimum standard deviation and may be compared with experimentally derived standard deviations. The effects of ethylene oxide sterilization, other sterilization techniques, and agar thickness are evaluated. To prevent the interference of unexpected variables with results, experimental designs should incorporate randomization of procedural variables. (See also W79-09881) (Lisk-FRC)
W79-09885

EFFECT OF INJURY ON THE RECOVERY OF INDICATOR BACTERIA ON MEMBRANE FILTERS,
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
A. W. Hoadley.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 34-41, 1977. 6 fig, 2 tab, 11 ref.

Descriptors: *E. coli, *Streptococcus, *Membranes, *Selectivity, *Sewage bacteria, Membrane processes, Pollutant identification, Analytical techniques, Cultures, Filters, Water quality analysis, Waste water treatment, Chlorination.

Injury to indicator bacteria during aqueous suspension or by contact with chlorine has been shown to adversely affect colonization on membrane filters incubated on selective media. Both Trypticase soy agar and membrane filters incubated on M-FC medium at 44.5 C performed equally well in the recovery of dividing cells of Escherichia coli, but recovery efficiency decreased with time of exposure to stress. A recovery efficiency of less than 50% was observed for Streptococcus faecalis in aqueous suspension recovered on membrane filters incubated in KF agar and on M-Enterococcus agar; recovery did not decrease with time of suspension. It is recommended that a media be formulated which permits colonization of viable cells. (See also W79-09881) (Lisk-FRC)
W79-09886

EFFECTS OF TEMPERATURE ON THE RECOVERY OF FECAL COLIFORMS,
Missouri Univ.-Rolla. Dept. of Life Science.
J. B. Hufham.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 42-45, 1977. 5 tab.

Descriptors: *E. coli, *Membranes, *Filtration, *Thermal stress, *Analytical techniques, Testing procedures, Coliforms, Sewage bacteria, Performance testing, Cultures, Water quality analysis, Waste water treatment.

The differential effects of temperature on various types of membrane filters and on the recovery of fecal coliforms were investigated. Various types of membranes have exhibited recovery rates for pure cultures of E. coli of known densities ranging from 10-70%. Other variables in the recovery of E. coli include medium, temperature, and the organism itself which must be a pure culture, easy to obtain, E. coli, and not selected for by the M-FC procedure. Results of the study indicated that incubation of E. coli at 44.5 C destroyed about 40% of the cells, even in the absence of a membrane filter. Incubation at 35 C resulted in good differentiation between E. coli and E. aerogenes by M-FC techniques. Millipore membranes inhibited about 50% of the cells, attributed to a heat soluble factor. Incubation on Millipore membranes at 44.5 C selected for mutants capable of surviving under these conditions. The establishment of a test strain of E. coli was recommended and better correlation of plate counts at different temperatures was urged. (See also W79-09881) (Lisk-FRC)
W79-09887

OPTIMUM MEMBRANE STRUCTURES FOR GROWTH OF FECAL COLIFORM ORGANISMS,
Millipore Corp., Bedford, MA.
K. J. Sladek, R. V. Suslavich, B. I. Sohn, and F. W. Dawson.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 46-57, 1977. 7 fig, 2 tab, 6 ref.

Descriptors: *Coliforms, *Membranes, *Design criteria, *Pores, *Surfaces, Retention, Membrane processes, Material testing, Physical properties, Analytical properties, Techniques.

An investigation was made of the optimum structure and properties of membrane filters for the recovery of fecal coliforms. Other parameters affecting coliform recovery on membrane filters were studied and included sterilization techniques and membrane composition. The characteristics of the membrane filter which significantly influence the growth of fecal coliforms were evaluated with various samples. The most critical factor in coliform recovery was the surface pore morphology. Significant increases in fecal coliform counts were observed with increasing surface opening sizes. The optimum growth of fecal coliforms occurred when the surface openings of the membrane structures were large enough to surround entrapped bacteria. The chemical composition of the membrane also had an impact on the growth of coliforms. Membranes composed of mixed esters of cellulose having a surface opening diameter of 2.4 micrometers and a retention pore size of 0.7 micrometers exhibited the maximum fecal coliform recoveries. (See also W79-09881) (Lisk-FRC)
W79-09888

A COMPARISON OF MEMBRANE FILTERS AND MEDIA USED TO RECOVER COLIFORMS FROM WATER,
Ontario Ministry of Health, Toronto. Lab. Services Branch.
M. H. Brodsky, and D. A. Schieman.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 58-63, 1977. 6 tab, 5 ref.

Descriptors: *Coliforms, *Membranes, *Filters, *Analytical techniques, *Cultures, Evaluation, Testing, Performance, Laboratory tests, Water pollution, Water quality analysis.

Three membrane filters manufactured by different companies for the recovery and enumeration of coliforms in water were compared. Parallel analyses were performed with membrane filters supplied by Johns-Manville Company of Canada (045 MO 47SG), Millipore Corporation (HAWG 47SO), and Sartorius Company (11456). The study also compared the performance of LES Endo agar and M-Endo broths with agar added. Laboratories performed 82 comparisons between the Johns-Manville and the Sartorius filters and 68 comparisons between the Johns-Manville and Millipore filters. Two phases of the study used routine water samples while a third phase utilized water samples from a known polluted river. Results of the three phase studies did not correlate but statistical evaluation of the results indicated that Johns-Manville and Millipore membrane filters were equivalent and superior to the Sartorius filters for the enumeration of coliforms. No significant difference between coliform recovery on the two culture media studied. (See also W79-09881) (Lisk-FRC)
W79-09889

COMPARISON OF MEMBRANE FILTERS IN RECOVERY OF NATURALLY INJURED COLIFORMS,
Montana State Univ., Bozeman. Dept. of Microbiology.
D. G. Stuart, J. E. Schillinger, and G. A. McFeters.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 64-66, 1977. 7 ref.

Descriptors: *E. coli, *Membranes, *Cultures, *Evaluation, *Sewage, Filters, Analytical techniques, Statistical methods, Natural streams, Water quality analysis, Waste water treatment.

The recovery and enumeration of E. coli in raw sewage and cultures utilizing the M-FC test with and without enrichment and with different brands of membrane filters were performed. The membrane filters compared were Millipore, Gelman, and Nuclepore; M-Endo MF medium at 35 C was used for E. coli experiments and M-FC fecal coliform medium at 44.5 C was used for sewage samples. Natural injury to the coliforms was performed by 24 hrs exposure to a natural aquatic environment. Enrichment was provided by a mixture of Trypticase soy broth, 0.5% glucose, and 0.3% yeast extract. Significant differences among the 3 filters were observed at the 0.01 level for sewage and the 0.005 level for E. coli with Millipore and Gelman providing similar results. ANOVA, F and t statistics indicated that Gelman had a very slight advantage over Millipore recovery. Comparisons of the enriched and nonenriched cultures indicated that the washed E. coli cells were more sensitive to filter and test variations than raw sewage coliforms. The use of Nuclepore membrane filters was not recommended. (See also W79-09881) (Lisk-FRC)
W79-09890

EFFICIENCY OF COLIFORM RECOVERY USING TWO BRANDS OF MEMBRANE FILTERS,
Environmental Protection Agency, Kansas City, KS. Surveillance and Analysis Div.
F. L. Harris, and C. A. Bailey.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 67-72, 1977. 3 tab, 6 ref.

Descriptors: *Membranes, *Filters, *Coliforms, *Material testing, *Cultures, Membrane processes, Quality control, Evaluation, Sewage bacteria, Analytical techniques, Testing procedures, Sewage effluents, Streams.

Gelman and Millipore filters were compared for the recovery of coliforms from nonchlorinated aerobic lagoon influent and effluent, river water, and sewage treatment plant effluent. A total of 100 aqueous samples were tested on 0.45 micrometer porosity membrane filters. The Gelman filters recovered 2.5 times more fecal coliform bacteria than the Millipore filters when the same samples and processing techniques were employed. Recovery of total coliforms was similar for the two test filter brands. Confirmation of the fecal coliform colonies was performed by subculturing 10 randomly picked blue colonies on other culture media. (See also W79-09881) (Lisk-FRC)
W79-09891

COMPARISON OF MEMBRANE FILTER BRANDS FOR RECOVERY OF THE COLIFORM GROUP,
National Marine Water Quality Lab., Narragansett, RI.
A. P. Dufour, and V. J. Cabelli.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 73-81, 1977. 8 tab, 2 ref.

Descriptors: *Membranes, *Filters, *E. coli, *Sewage bacteria, *Testing procedures, Coliforms, Analytical techniques, Membrane processes, Cultures, Sampling, Water quality control.

Millipore, Gelman, Sartorius, Schleicher and Schuell, and Nuclepore filters were compared for the recovery of E. coli, K. pneumonia, and Enterobacter cloacae from natural waters utilizing the M-FC test procedure. Recoveries of pure cultures or natural source fecal coliforms were not significantly affected by the brand of membrane filter, except in the case of Nuclepore filters. With natural water samples, the variability of the recovery increased. The filter brand did affect the precision of the M-FC test. (See also W79-09881) (Lisk-FRC)
W79-09892

A COMPARISON OF MEMBRANE FILTERS, CULTURE MEDIA, INCUBATION TEMPERATURES, POLLUTED WATER AND ESCHERICHIA COLI STRAINS IN THE FECAL COLIFORM TEST,
Pennsylvania State Univ., University Park. Dept. of Veterinary Science.
P. J. Glantz.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 82-97, 1977. 9 tab, 12 ref.

Descriptors: *E. coli, *Membranes, *Filters, *Cultures, *Analytical techniques, Sewage bacteria, Evaluation, Testing procedures, Membrane processes, Temperature, Coliforms, Water quality control.

Millipore, Gelman, and Sartorius membrane filters were compared for the recovery of fecal coliforms and E. coli isolated from polluted water. The effects of temperature on bacterial growth were investigated with incubation temperatures of 35, 43, and 44.5 C. Actual E. coli counts were obtained with Trypticase soy agar and were compared with counts on M-FC and violet red bile agar. Bacteria grew better on the violet red bile agar than on the M-FC medium and was not always affected by 44.5 C incubation temperature. The E. coli strains grew better on the membrane filters than on the poured agar plates. The strain of E. coli, the growth method utilized, and the temperature inside the plate influenced the usefulness of the membrane filter for the fecal coliform test. (See also W79-09881) (Lisk-FRC)
W79-09893

RECOVERY CHARACTERISTICS OF BACTERIA INJURED IN THE NATURAL AQUATIC ENVIRONMENT,
Montana State Univ., Bozeman. Dept. of Microbiology.
G. K. Bissonnette, J. J. Jezeski, G. A. McFeters, and D. G. Stuart.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 98-100, 1977.

Descriptors: *E. coli, *Streptococcus, *Environmental effects, *Cultures, *Growth rates, Membranes, Filters, Membrane processes, Selectivity, Analytical techniques.

Stress induced by the aquatic environment on indicator bacteria was evaluated as a potential cause of injury which can prevent identification and enumeration by direct selective techniques. Membrane chambers were filled with Escherichia coli or Streptococcus faecalis, immersed in different stream sites, and sampled daily. Organisms were grown in Trypticase soy agar and desoxychloate agar to determine the maximum number of recoverable organisms and the number of bacteria capable of forming colonies on selective medium. Results of the study indicated that the recovery and enumeration of the organisms were adversely affected by some of the conditions at the test sites. Additional tests were also conducted on the efficiency of various selective media in the recovery of E. coli that were debilitated in natural water; liquid media were found more effective than broth plating or membrane filtration techniques for recovering E. coli and S. faecalis. A third study evaluated the capacity of injured cells to repair themselves in the presence of a suitable environment. Results indicated that brief exposure of the cells to a rich, non-selective medium prior to the use of a selective medium resulted in significant repair from environmental injury. Membrane filtration procedures were especially suitable for this procedure. (See also W79-09881) (Lisk-FRC)
W79-09894

A LAYERED MEMBRANE FILTER MEDIUM FOR IMPROVED RECOVERY OF STRESSED FECAL COLIFORMS,

R. E. Rose, E. E. Geldreich, and W. Litsky.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 101-108, 1977. 6 tab, 13 ref.

Descriptors: *Analytical techniques, *Coliforms, *Membrane processes, *Sewage bacteria, *Water pollution sources, Chlorination, Filters, Quality control, Testing procedures, Sewage effluents.

A method developed for the improved recovery of stressed fecal coliforms on membrane filters utilizes a two layered agar method with temperature acclimation, lactose enrichment, and diffusion transfer into M-FC agar. Samples of raw and chlorinated waste water and reservoir, river, and marine waters were used in field tests at three laboratories. The two layer technique verified 1013 typical blue colonies from a total of 61 water samples for an average verification rate of 92%. The two layer technique exhibited a higher sensitivity for fecal coliforms in chlorinated secondary effluents, marine waters, and natural water containing pollutants with heavy metal ions, compared to direct M-FC methods. (See also W79-09881) (Lisk-FRC)
W79-09895

MEASUREMENT OF FECAL COLIFORMS IN ESTUARINE WATER,
A. P. Stevens, R. J. Grasso, and J. E. Delaney.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 109-112, 1977. 1 fig, 1 tab, 2 ref.

Descriptors: *Coliforms, *Analytical techniques, *Membranes, *Membrane processes, *Testing procedures, Cultures, Estuarine environment, Filters, Bioindicators, Laboratory tests, Water quality control, Pollutant identification, Incubation.

Standard membrane filter (MF) procedures and standard most probable number EC (MPN) counts were compared for the recoveries of fecal coliforms from estuarine waters. A two-step procedure was developed in which the fecal coliforms are acclimated prior to exposure to the selective temperature of 44.5 C. A minimal holding agar, containing tryptose, dextrose, lactose, oxgall, sodium chloride, and agar, is allowed to warm to room temperature prior to placement of the membrane filter on the agar. The dishes are sealed, placed in a plastic bag and inverted in a water bath at 25 C for about 18 hrs. The membranes are then transferred to absorbent pads in sealed dishes that have been saturated with M-FC broth (about 1.7-1.8 ml broth/pad). The dishes are reincubated at 44.5 C for 24 hrs. This procedure recovered about 85% of the MPN count compared to about 24% by the standard MF technique. The procedure obtained 93% verification of the colonies. Further studies revealed that the batches and brands of membrane filters significantly affected the recovery of fecal coliforms in estuarine water. (See also W79-09881) (Lisk-FRC)
W79-09896

EVALUATION OF METHODS FOR DETECTING COLIFORMS AND FECAL STREPTOCOCCI IN CHLORINATED SECONDARY SEWAGE EFFLUENTS,
Illinois State Water Survey, Peoria. Water Quality Section.
S. Lin.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 113-132, 1977. 13 fig, 10 tab, 34 ref.

Descriptors: *Membrane processes, *Chlorination, *Coliforms, *Streptococcus, *Cultures, Analytical techniques, Sewage bacteria, Laboratory tests, Testing procedures, Pollutant identification, Disinfection, Waste water treatment, Water quality control.

Membrane filter and most probable number (MPN) methods were used for the recovery of fecal coliforms, total coliforms, and fecal streptococci from chlorinated secondary sewage effluents. Comparable results for recovering total coliforms were obtained by the LES two-step membrane filter technique and the MPN procedure. The LES two-step method detected 1.5-fold more total coliforms than the M-Endo one-step membrane filter procedure. The MPN technique recovered more fecal coliforms than the M-FC membrane filter technique. The M-Enterococcus agar procedure with bile broth enrichment or extended incubation for 3 days produced fecal streptococci recoveries comparable to the MPN technique; the M-Enterococcus agar two day incubation procedure was not enhanced by the use of either azide dextrose broth, brain-heart infusion broth, or peptone yeast-extract Casitone. Results of the study were considered useful for evaluating the efficiency of disinfection practices for waste water treatment plants utilizing chlorination. (See also W79-09881) (Lisk-FRC)
W79-09897

THE ASTM PROPOSED MEMBRANE FILTER TEST PROCEDURE FOR THE RECOVERY OF FECAL COLIFORMS,
Microbe One, Ann Arbor, MI.
M. J. Jackson, D. W. Davis, and G. R. Kinzer.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 133-152, 1977. 1 fig, 4 tab, 8 ref.

Descriptors: *Analytical techniques, *Testing procedures, *Membrane processes, *Filters, *Cultures, Laboratory tests, Coliforms, Sewage bacteria, Water pollution, Water analysis, Membranes.

A comparison of various membrane filters for the recovery of fecal coliforms was conducted with Sartorius, Gelman, John-Mansville, Oxoid, Millipore, and S and S filters. Four samples of polluted water and one raw sewage sample were used in the tests; samples were incubated on M-FC agar at 44.5 C for 22-24 hrs. Samples were also tested on M-FC agar by the pour plate or the spread plate technique and replicate counts were compared with counts on the membrane filters. Nine laboratories participated in the experiments and their results indicated differences in filter brands and in resulting laboratory data. Further tests were considered necessary to eliminate variables. (See also W79-09881) (Lisk-FRC)
W79-09898

CRITIQUE ON ASTM TEST FOR RECOVERY OF FECAL COLIFORMS AND PROPOSAL FOR MODIFIED METHOD,
Sartorius Membrane Filter (Germany, F.R.).
N. H. Goddard.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 153-156, 1977.

Descriptors: *Analytical techniques, *Coliforms, *Testing procedures, *Membranes, *Filters, Design standards, Cultures, Bioindicators, Laboratory tests, Testing, Water analysis, Laboratory equipment.

Recommendations for the standardization of fecal coliform recovery on membrane filters are presented. These include: the use of a flora more favorable in sewage than polluted waters, such as potable water spiked with a pure culture; standardization of sample mixing conditions; separation of coliform and non-coliform counts; randomization of sample positions during incubation; and verification of thermometer and incubator settings. Also, results of a routine method must be comparable to results of other methods such as a pour plate method and must be reproducible independent of the testing laboratory or the person performing the test. The medium should be selective and not interfere with the identification of the colonies. The method should also be simple, practical, and useable in any testing laboratory. (See also W79-09881) (Lisk-FRC)
W79-09899

COMPARISON OF MEMBRANE FILTER COUNTS AND PLATE COUNTS ON HETEROTROPHIC AND OIL AGAR USED TO ESTIMATE POPULATIONS OF YEAST, FUNGI AND BACTERIA,
Maryland Univ., College Park. Dept. of Microbiology.
J. D. Walker, B. F. Conrad, P. A. Seesman, and R. R. Colwell.
In: Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters, January 20-21, 1975, Fort Lauderdale, Florida, p 178-187, 1977. 15 tab, 4 ref.

Descriptors: *Membranes, *Yeasts, *Fungi, *Marine bacteria, *Analytical techniques, Membrane processes, Filters, Performance, On-site tests, Testing procedures, Water analysis.

Membrane filter and plate counts of yeasts, fungi, and bacteria on heterotrophic and oil agar were compared. The membrane filters were found to consistently yield higher counts of years and fungi than plate counts. Filter counts were about 80% lower than plate counts for recovery of heterotrophic estuarine and marine bacteria. Millipore filters were found to be sturdier and easier to use than Nuclepore filters for field work. (See also W79-09881) (Lisk-FRC)
W79-09900

8. ENGINEERING WORKS

8A. Structures

APPARATUS AND METHOD FOR CONTROLLING TIDE WATERS,
E. A. Salo.
U.S. Patent No. 4,146,346, 5 p, 7 fig, 5 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1374, March 27, 1979.

Descriptors: *Patents, *Tidal waters, *Tidal streams, Saline water intrusion, Tidal effects, Water control, Weirs, Floating, Structures.

The salinity intrusion of ocean tidewater into a communicating fresh water river is prevented by laterally restricting the out-flow cross-section of the river with a series of flotation weirs and control weirs so that the surface level of the out-flow cross-section is higher than the surface level of the adjacent tidal salt water. The weirs are located so as to not obstruct the ship channel of the river. (Sinha-OEIS)
W79-09938

POWER PRODUCTION AT FEDERAL DAMS COULD BE INCREASED BY MODERNIZING TURBINES AND GENERATORS.
General Accounting Office, Washington, DC. Energy and Minerals Div.
For primary bibliographic entry see Field 8C.
W79-09991

CENTRAL ARIZONA PROJECT RE:CAP, INFORMATION PACKET NO. 1.
Bureau of Reclamation, Phoenix, AZ.
Nov. 1978, 8 p. 13 fig.

Descriptors: *Central Arizona Project, *Water resources development, *Multiple purpose projects, *Project purposes, *Water allocation(Policy), *Water supply, Structures, Comprehensive planning, Legislation, History, Regional development, Water law, Water conservation, Legal aspects, Distribution systems, Arizona, Aqueducts, Water storage, Conveyance structures.

The history, description, status and water supply of the Central Arizona Project (CAP) are described here in the first of a series of five summary information packets designed to increase public awareness of the CAP and related water supply and environmental issues. Colorado River water, a valuable commodity in the arid west, has been the subject of intense political negotiations, scientific engineering investigations, and legal debate spanning decades. A summary of these historical issues is presented with a separate description of the many related parts of the CAP including the Gran-

ite Reef aqueduct, Salt-Gila aqueduct, Tucson aqueduct, Buttes Dam and Reservoir, Salt-Gila regulatory storage, Indian distribution systems and other authorized features. Discussions of the sufficiency of Colorado River flows to service CAP diversions and the extent to which CAP water will affect Tucson area water supplies indicate that as CAP deliveries increase, Pima County can begin to balance its water use with available annual supplies if other measures, such as retirement of farmland, re-use of sewage effluent, conservation programs, etc. are applied. Although the many related parts of the CAP are due to be completed at different times, water delivery to the Tucson area is scheduled for 1987 and to the Phoenix area in 1985. (See W79-10061 thru W79-10064) (Tickes-Arizona)
W79-10060

CENTRAL ARIZONA PROJECT RECAP, INFORMATION PACKET NO. 4.
Bureau of Reclamation, Phoenix, AZ.
Jan. 1979, 6 p. 7 fig, 1 tab.

Descriptors: *Water storage, *Water resources planning, *Energy conservation, *Central Arizona Project, *Subsidence, *Groundwater resources, Future planning(Projected), Project planning, Energy budget, Environmental effects, Water supply, Aqueducts, Conveyance structures, Groundwater mining, Arizona.

Central Arizona Project (CAP) energy use, subsidence and earth fissures related to groundwater pumping and the regulatory and terminal storage of CAP water are described in this fourth in a series of five summary information packets which describe the Central Arizona Project and related water supply and environmental issues. Large CAP energy requirements are supplied from a portion of the Navajo Generating Capacity purchased expressly for this purpose and efforts are currently underway to determine methods of operating the project in an energy-conserving manner. These efforts and naturally occurring variations in CAP operating capacity will result in the production at times of power in excess of project needs. It is expected that this power can be marketed to customers in the southwest. Subsidence and earth fissuring due to extensive use of groundwater in Arizona are problems that can only be stopped by achieving a balance between groundwater pumpings and recharge. Although the CAP is expected to aid in reducing this problem, more information about the conditions under which these phenomena take place is needed. The needs for and value of regulatory and terminal storage facilities are well documented although sites for the development of such facilities have yet to be selected on the CAP system. The Bureau of Reclamation and U. S. Army Corps of Engineers are in the initial stages of studying this problem. (See also W79-10060) (Tickes-Arizona)
W79-10063

CONSTRUCTION COSTS FOR MUNICIPAL WASTEWATER TREATMENT PLANTS: 1973-1977.
Dames and Moore, Denver, CO. Water Pollution Control Engineering Services.
For primary bibliographic entry see Field 5D.
W79-10080

8B. Hydraulics

FLOW MONITORING,
Pro-Tech, Inc., Paoli, PA. (Assignee).
K. W. Martig, Jr.
U.S. Patent No. 4,145,926, 5 p, 3 fig, 4 ref; Official Gazette of the United States Patent Office, Vol. 980, No. 4, p 1233, March 27, 1979.

Descriptors: *Patents, *Monitoring, *Measurement, *Flow, Sewerage, Combined sewers, Open channels, Depth, Sensors.

A method is provided for monitoring liquid flow in an open pipe or conduit. A sensor is located adjacent the invert or at the inside of the bed and the depth of liquid is determined by the bubbler method. To minimize interferences with the liquid flow the bubble fluid is conducted from the exterior along the inside wall and to the vicinity of the flow bed in the pipe or conduit. The sensor and the bubble fluid conductor are retained in place by supporting means adapted to be expanded into secure frictional engagement with the inside wall of the pipe or conduit. The flow is determined by releasing the bubble fluid bubble-wise against the static pressure of the overlying liquid, sensing such pressure, indicating it in terms of liquid depth, and converting depth to flow by conventional methods. (Sinha-OEIS)
W79-09936

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, TECHNICAL DATA VOLUME 2: ENGINEERING CRITERIA,
Metcalf and Eddy, Inc., Boston, Mass.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 794, Price codes: A07 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 142 p, 18 fig, 19 tab, 2 append.

Descriptors: *Costs, *Massachusetts, *Design criteria, *Waste water treatment, *Sanitary engineering, Design standards, Connstruction, Engineering structures, Specifications, Effluents, Cost analysis, Sludge treatment, Sewers, Outfall sewers, Pumping plants, Tunnels, Infiltration, Inflow, Boston(MA), Waste water management.

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area. It covers the engineering criteria used in proposed projects, including the bases of estimating wastewater flows, sewerage needs and costs. Projections of sewerage needs and wastewater flow are made for each community. Dry weather waste water flows are first investigated. The population and economic area served are reviewed and area sewering explained. Total annual volumes of water consumption are calculated and sewage flows are developed. A flow quantification procedure is outlined. Major and other industrial flows are reviewed and peak flows studied; a composition of process wastewaters is presented. An infiltration/inflow analysis looks at both the Nut Island and Deer Island Treatment Plant flows. An infiltration allowance procedure is outlined and allowances are selected. Treatment criteria are analyzed and design parameters discussed. Finally, cost bases are reviewed for different facilities. Two appendices present analyses on infiltration and salt water intrusion. (See also W79-09992) (Zayac-NC)
W79-09994

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 7: COMBINED SEWER OVERFLOW REGULATION,
Metcalf and Eddy, Inc., Boston, MA.
For primary bibliographic entry see Field 5F.
W79-09999

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 8: URBAN STORMWATER MANAGEMENT,
Army Engineer District, Waltham, MA. New England Div.
For primary bibliographic entry see Field 5F.
W79-10000

WASTEWATER ENGINEERING AND MANAGEMENT PLAN FOR BOSTON HARBOR-EASTERN MASSACHUSETTS METROPOLITAN AREA, EMMA STUDY, VOLUME 9: MDC INTERCEPTOR AND PUMPING STATION ANALYSIS AND IMPROVEMENTS.
Metcalf and Eddy, Inc., Boston, MA.
Available from the National Technical Information Service, Springfield, VA 22161 as AD-A036 803, Price codes: A12 in paper copy, A01 in microfiche. Prepared for the Metropolitan District Commission, Commonwealth of Massachusetts, October 1975. 256 p, 6 fig, 28 tab, 7 append.

Descriptors: *Massachusetts, *Waste water treatment, *Sewers, *Interceptor sewers, *Model studies, *Waste water management, *Treatment facilities, *Pumping stations, *Headworks, Conveyance structures, Engineering structures, Hydraulic structures, Cost analysis, Simulation, Analytical techniques, Boston(MA).

This is part of a study addressing methods of combatting pollution in the Boston Harbor-EMMA area and vitally affecting the Metropolitan Sewerage District. The purpose of this volume is to inventory and evaluate the MDC interceptors, pumping stations and headworks in terms of their adequacy to meet projected needs under various concepts and the recommended plan, and to recommend the general upgrading required at the pumping stations and headworks. The existing system is described and the evaluation procedure outlined. For each of four proposed service area concepts, sewer relief requirements are presented and compared in terms of cost and priorities. The wastewater pumping stations and headworks are analyzed and improvements suggested by looking at capacity requirements. Each of the 10 main pumping stations is analyzed separately and estimated rehabilitation or replacement costs presented, ranging from $203,000 to rehabilitate the Houghs Neck station to $6,000,000 to replace the Charlestown station. The interceptor system was evaluated through computer modeling of the MDC sewers in order to determine their hydraulic adequacy to transport projected flows. A series of appendices presents interceptor data and modeling packages; modeling results are discussed. Inventories of the pumping stations and headworks are included. (See also W79-09992) (Zayac-NC)
W79-10001

A STUDY OF THE PERMANENT EFFECTS OF ELEVATED TEMPERATURE ON THE HYDRAULIC PROPERTIES OF CLAY,
Auburn Univ., AL. Dept. of Civil Engineering.
D. R. Cullen.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-200 686, Price codes: A05 in paper copy, A01 in microfiche. MS Thesis, August 1979, 74 p, 20 fig, 18 tab. OWRT A-069-ALA(1).

Descriptors: Kaolinite, Illite, Bentonite, Temperature, *Clays, *Hydraulic conductivity.

The constant rate of strain consolidometer was employed in the study of the permanent effects of elevated temperature on the hydraulic properties of Georgia kaolinite, Urbana illite, and bentonite. Samples consolidated from a slurry were heat treated at temperatures of 20, 90, and 160 degrees C for twelve hours and tested using the constant rate of strain consolidation technique at 20 degrees C to measure hydraulic conductivity, volume compressibility and the coefficient of consolidation. The one-way analysis of variance (fixed effects model) was employed to test for significant linear and quadratic temperature effects. The level of statistical significance was determined for each test. Urbana illite demonstrated a significant quadratic temperature effect in terms of hydraulic conductivity, which was maximized by the 90 degree C treatment. The bentonite clay sample was found to have significant temperature effects associated with hydraulic conductivity and volume compressibility. These effects were linear and positive. Georgia kaolinite did not display significant changes in hydraulic properties caused by temperature.
W79-10022

8C. Hydraulic Machinery

POWER PRODUCTION AT FEDERAL DAMS COULD BE INCREASED BY MODERNIZING TURBINES AND GENERATORS.

General Accounting Office, Washington, DC. Energy and Minerals Div.
Available from the National Technical Information Service, Springfield, VA 22161 as PB-269 254, Price codes: A02 in paper copy, A01 in microfiche. Report EMD-77-22, March 16, 1977. 15 p, 1 append.

Descriptors: *Dams, *Hydroelectric power, *Efficiencies, Electric power, Electric power production, Hydroelectric plants, Equipment, Electrical equipment, Electrical generators, Turbines, Hydraulic turbines, Turbine runners, Energy, Modernizing.

Existing Federal hydroelectric plants could increase power production by modernizing turbines to increase efficiencies and capacities and by modernizing generators to increase capacities. Increasing hydroelectric power production: (1) will increase the Nation's energy supply, (2) will displace consumption of nonrenewable fuels by fossil-fueled power plants, (3) will reduce pollution, (4) will increase Federal revenues, and (5) will displace or delay construction of alternate power sources. Federal agencies that operate hydroelectric plants should evaluate existing plants to identify and act on these opportunities. (Sims-ISWS)
W79-09991

8D. Soil Mechanics

ENGINEERING PROBLEMS ASSOCIATED WITH EXPANSIVE CLAYS FROM ROMANIA,
Institutul de Constructii din Bucuresti (Romania). Dept. of Soil Mechanics and Foundation Engineering.
For primary bibliographic entry see Field 2G.
W79-09972

9. MANPOWER, GRANTS AND FACILITIES

9C. Research Facilities

WATER ANALYSIS IN SOUTH AFRICA: INTERLABORATORY COMPARISON STUDIES, PART IV: MINERAL ANALYSIS,
National Inst. for Water Research, Pretoria (South Africa).
R. Smith.
Water S.A., Vol. 5, No. 2, p 61-69, April 1979. 8 fig, 4 tab, 13 ref.

Descriptors: *Water analysis, *Laboratory tests, Water chemistry, Sodium, Potassium, Calcium, Magnesium, Chlorides, Sulfates, Fluorides, Alkalinity, Laboratory equipment, Volumetric analysis, Flame photometry, Cations, South Africa.

Sixteen South African water analysis laboratories performed mineral analyses on samples of known concentrations for sodium, potassium, calcium, magnesium, chloride, sulphate, fluoride, and total alkalinity. Each laboratory was supplied with six 250cc samples, allowed to use any analytical method desired, and allowed one month to return their results. Each laboratory was allocated a code number, known only to that laboratory and the originator of the study. Nine of the participants determined sodium by the flame photometric technique, while seven used atomic absorption. For potassium, ten laboratories used flame photometry and six atomic absorption. For both, atomic absorption results had a slightly better degree of precision. For calcium and magnesium, nine laboratories used atomic absorption, while seven employed titration methods. Again, atomic absorption results were more accurate. Comparisons between automated and manual methods of analysis for chloride and sulphate showed no significant differences in precision or accuracy. Fluoride results showed good accuracy and precision with analysis by ion-selective electrode being the most popular method. Potentiometric titration gave more accurate results than other methods for total alkalinity. Overall, only about 7% of the results could be regarded as unacceptable according to Greenberg's assessment method. Study results compared favorably with those from similar overseas studies. (Seigler-IPA)
W79-09841

SUBJECT INDEX

ABSORPTION
Exchange of Certain Radionuclides Between the Environment and Fresh-Water Algae,
W79-09923 5C

ACIDIC WATER
Interaction Between Simulated Rain and Barren Rock Surface,
W79-09981 2K

ADVANCED WASTEWATER TREATMENT
Water Factory 21 Design and Operating Data,
W79-09961 5D

AESTHETICS
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13D: Visual, Cultural and Design Impact Analysis,
W79-10009 6B

AGING (PHYSICAL)
Grain Coarsening of Water-Saturated Snow,
W79-09975 2C

AGRICULTURAL RUNOFF
User's Manual for Agricultural Runoff Management (ARM) Model,
W79-09904 5G

The Quality of Run-Off from an Irrigated Market Garden Area in Brazil,
W79-09985 5B

AGRICULTURE
Subsidence Related to Land Use in Everglades Agricultural Area,
W79-09968 4A

ALASKA
Sorting and Identification of Intertidal Samples,
W79-10036 5C

Migration of Birds in Alaska Marine Habitats,
W79-10046 5C

ALGAE
Exchange of Certain Radionuclides Between the Environment and Fresh-Water Algae,
W79-09923 5C

ALPINE
The Formation of Medial Moraines on Alpine Glaciers,
W79-09973 2C

ANAEROBIC CONDITIONS
Biostimulants,
W79-10057 5C

ANALYTICAL TECHNIQUES
Statistical Interpretation of Membrane Filter Bacteria Counts,
W79-09885 7B

Effects of Temperature on the Recovery of Fecal Coliforms,
W79-09887 7B

A Comparison of Membrane Filters and Media Used to Recover Coliforms from Water,
W79-09889 7B

A Comparison of Membrane Filters, Culture Media, Incubation Temperatures, Polluted Water and Escherichia Coli Strains in the Fecal Coliform Test,
W79-09893 7B

A Layered Membrane Filter Medium for Improved Recovery of Stressed Fecal Coliforms,
W79-09895 7B

Measurement of Fecal Coliforms in Estuarine Water,
W79-09896 7B

The ASTM Proposed Membrane Filter Test Procedure for the Recovery of Fecal Coliforms,
W79-09898 7B

Critique on ASTM Test for Recovery of Fecal Coliforms and Proposal for Modified Method,
W79-09899 7B

Comparison of Membrane Filter Counts and Plate Counts on Heterotrophic and Oil Agar Used to Estimate Populations of Yeast, Fungi and Bacteria,
W79-09900 7B

Analysis of Nitrate Content of Surface Water and Effluent Water. Applications of a Plastic-Membrane Nitrate-Selective Electrode in Water Quality Monitors,
W79-09920 5C

Toxicity of Gallium and Beryllium to Developing Carp Eggs (Cyprinus Carpio) Utilizing Copper as a Reference,
W79-09958 5C

A Simplified Method for the Simulataneous Extraction of Phytoplanktonic Chlorophyll and Fecal Sterol from Water,
W79-09979 5A

Construction Costs for Municipal Wastewater Treatment Plants: 1973-1977.
W79-10080 5D

ANDROSCOGGIN COUNTY (ME)
Flood Hazard Analyses, Worthley Brook, Town of Poland, Maine, Androscoggin County,
W79-10014 2E

ANIMAL BEHAVIOR
Factors Affecting the Burrowing Activity of Macoma Balthica (L.),
W79-09959 5C

ANIMAL DISEASES
Nitrate Levels in Groundwater from the Fleuve, Senegal,
W79-10067 5A

ANTARCTIC
Pattern of Ice Surface Lowering for Rennick Glacier, Northern Victoria Land, Antarctica,
W79-09974 2C

AQUATIC MICROBIOLOGY
Distribution of Phytoplankton in Louisiana Lakes,
W79-10026 2H

Distribution of Phytoplankton in South Dakota Lakes,
W79-10027 2H

AQUATIC PLANTS
Biostimulants,
W79-10057 5C

AQUATIC POPULATIONS
Distribution Patterns and Population Dynamics of Polyphemus Pediculus (L.) (Crustacea, Cladocera) in a Small New England Lake,
W79-09836 2H

AQUIFERS
Lagoon Recharge of the Folkestone Beds at Hardham, Sussex--1972-75,
W79-09988 4B

ARCHEOLOGY
Anthropological Investigations Near the Crest of the Continent, 1975-1978,
W79-09840 6G

ARCTIC
Acute Toxicity of Heavy Metals,
W79-10041 5C

Pathology of Arctic and Subarctic Marine Species and Exposure to Trace Metals Associated with Petroleum,
W79-10042 5C

AREA REDEVELOPMENT
Rural Water Development in Arid Regions,
W79-10065 6G

ARID LANDS
Rural Water Development in Arid Regions,
W79-10065 6G

ARTIFICIAL RECHARGE
Lagoon Recharge of the Folkestone Beds at Hardham, Sussex--1972-75,
W79-09988 4B

ATLANTIC OCEAN
Local and Mesoscale Influences on Nutrient Variability in the Northwest African Upwelling Region Near Cabo Corbeiro,
W79-09926 5C

ATMOSPHERIC PRECIPITATION
Rainfall in Southern California,
W79-10078 2B

ATMOSPHERIC PRESSURE
Rainfall in Southern California,
W79-10078 2B

ATTITUDES
Water Development in Wyoming: A Survey of Resident Attitudes, 1971,
W79-09833 6B

AUSTRALIA
A Cloud-Seeding Experiment in Tasmania,
W79-09963 2B

AUTROTROPHY
Autotrophy in Stream Ecosystems,
W79-09922 5C

BASELINE STUDIES
Distribution and Abundance of Some Epibenthic Invertebrates of the Northeastern Gulf of Alaska with Notes on the Feeding Biology of Selected Species,
W79-10033 5C

Finfish Resource Surveys in Norton Sound and Kotzebue Sound,
W79-10034 5C

Intertidal Biota and Subtidal Kelp Communities of the Kodiak Island Area,
W79-10035 5C

Sorting and Identification of Intertidal Samples,
W79-10036 5C

Baseline Studies of the Demersal Resources of the Eastern and Western Gulf of Alaska Shelf and Slope: A Historical Review,
W79-10037 5C

Beaufort Sea Estuarine Fishery Study,
W79-10038 5C

Preliminary Observations on the Distribution Abundance and Food Habits of Some Nearshore Fishes in the Northeastern Gulf of Alaska,
W79-10039 5C

Levels and Sources of Critical Trace Metals in the Marine Environment,
W79-10040 5B

Acute Toxicity of Heavy Metals,
W79-10041 5C

Metabolism of Trace Metals: Bioaccumulation and Biotransformation in Marine Organisms,
W79-10043 5C

BASELINE STUDIES

Behavioral and Physiological Effects Induced by Sublethal Levels of Heavy Metals,
W79-10044 5C

BEACH EROSION
Experimental Control of Beach Face Dynamics by Watertable Pumping,
W79-09971 2L

BEACHES
An Ecophysiological Study of the Meiofauna of the Swartkops Estuary. 3. Partition of Benthic Oxygen Consumption and the Relative Importance of the Meiofauna,
W79-09924 5C

BEDS
Application of Infinite Slope Analysis to Subaqueous Sediment Instability, Mississippi Delta,
W79-09970 2L

BENEFIT-COST ANALYSIS
A Comparison of Evaluations of Four Irrigation Projects,
W79-10019 6B

BENTHIC FAUNA
An Ecophysiological Study of the Meiofauna of the Swartkops Estuary. 3. Partition of Benthic Oxygen Consumption and the Relative Importance of the Meiofauna,
W79-09924 5C

BENTHIC FLORA
The Distribution and Seasonality of the Benthic Aquatic Macrophytes of the Pamlico River Estuary, North Carolina,
W79-09834 2L

BENTHOS
Distribution and Abundance of Some Epibenthic Invertebrates of the Northeastern Gulf of Alaska with Notes on the Feeding Biology of Selected Species,
W79-10033 5C

BIDS
Construction Costs for Municipal Wastewater Treatment Plants: 1973-1977.
W79-10080 5D

BIOACCUMULATION
Metabolism of Trace Metals: Bioaccumulation and Biotransformation in Marine Organisms,
W79-10043 5C

BIOCHEMICAL OXYGEN DEMAND
A Comparative Case Study of Dynamic Models for DO-BOD-Algae Interaction in a Freshwater River,
W79-09862 5A

BIOINDICATORS
Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters,
W79-09881 7B

The Membrane Filter Dilemma,
W79-09882 7B

BIOLOGY
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13A: Biological Impact Analysis,
W79-10006 6C

BIOSTIMULANTS
Biostimulants,
W79-10057 5C

BIOTA
Intertidal Biota and Subtidal Kelp Communities of the Kodiak Island Area,
W79-10035 5C

BIOTRANSFORMATION
Metabolism of Trace Metals: Bioaccumulation and Biotransformation in Marine Organisms,
W79-10043 5C

BIRDS
Ecological and Physiological/Toxicological Effects of Petroleum on Aquatic Birds. A Summary of Research Activities FY 76 Through FY 78,
W79-10031 5C

Migration of Birds in Alaska Marine Habitats,
W79-10046 5C

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-10047 5C

Avian Community Ecology of the Akulik-Inglutalik River Delta, Norton Bay, Alaska,
W79-10048 5C

BORON
Boron Distribution in Soils and Waters of Egypt,
W79-10073 2K

BOUSSINESQ EQUATION
An Analytical Solution for the Transient Ditch Drainage Problem,
W79-09984 2G

BRANCH AND BOUND METHOD
Procedure for the Economical Evaluation of Water Networks' Parameters,
W79-09866 6A

BRAZIL
The Quality of Run-Off from an Irrigated Market Garden Area in Brazil,
W79-09985 5B

BUDGET STUDIES
A Comparison of Evaluations of Four Irrigation Projects,
W79-10019 6B

CABO CORBEIRO (SPANISH SAHARA)
Local and Mesoscale Influences on Nutrient Variability in the Northwest African Upwelling Region Near Cabo Corbeiro,
W79-09926 5C

CANADA
Concentrations of Nitrilotriacetate and Certain Metals in Canadian Wastewaters and Streams: 1971-1975,
W79-09986 5B

CANALS
Canal Seepage with Boundary at Finite Depth,
W79-09990 2G

CANARY ISLANDS (SPAIN)
Las Palmas Phase II Desalination Plant in the Canary Islands (Spain),
W79-09874 3A

CAPITAL
Analysis of Investments in Technology Development and Resource Conservation,
W79-09854 6B

CATION EXCHANGE
Cation Exchange Equilibria in Florida and Indiana Histosols,
W79-09912 2K

CENTRAL ARIZONA PROJECT
Central Arizona Project RE:CAP, Information Packet No. 1.
W79-10060 8A

Central Arizona Project RE:CAP, Information Packet No. 2.
W79-10061 6C

Central Arizona Project RE:CAP, Information Packet No. 3.
W79-10062 5G

Central Arizona Project RE:CAP, Information Packet No. 4.
W79-10063 8A

Central Arizona Project RE:CAP, Information Packet No. 5.
W79-10064 6G

CHANCE-CONSTRAINED QUADRATIC PROGRAMMING
Regulation Model of the Lake Velence Reservoir System,
W79-09852 6A

CHAROPHYTA
Exchange of Certain Radionuclides Between the Environment and Fresh-Water Algae,
W79-09923 5C

CHEMICAL ANALYSIS
Nitrate Levels in Groundwater from the Fleuve, Senegal,
W79-10067 5A

Boron Distribution in Soils and Waters of Egypt,
W79-10073 2K

CHLORIDE
Nitrogen and Chloride Leaching in a Sandy Field Plot,
W79-09911 2G

CHLORINATION
Disinfection of Water: Pros and Cons,
W79-09845 5D

Evaluation of Methods for Detecting Coliforms and Fecal Streptococci in Chlorinated Secondary Sewage Effluents,
W79-09897 7B

A Morphological Defect in Shiner Perch Resulting from Chronic Exposure to Chlorinated Sea Water,
W79-09907 5C

Effects of Water-Soluble Chlorine-Containing Organics on Aquatic Environments--Another Perspective,
W79-09954 5C

Chlorination Products,
W79-10051 5C

CHLOROPHYLL
A Simplified Method for the Simulataneous Extraction of Phytoplanktonic Chlorophyll and Fecal Sterol from Water,
W79-09979 5A

CLADOPHORA GLOMERATA
Exchange of Certain Radionuclides Between the Environment and Fresh-Water Algae,
W79-09923 5C

CLAYS
A Study of the Permanent Effects of Elevated Temperature on the Hydraulic Properties of Clay,
W79-10022 8B

CLOUD PHYSICS
Changes in Cloud Base Precipitation Particle Size-Distributions as a Response Variable to Seeding,
W79-10025 2B

CLOUD SEEDING
A Cloud-Seeding Experiment in Tasmania,
W79-09963 2B

Changes in Cloud Base Precipitation Particle Size-Distributions as a Response Variable to Seeding,
W79-10025 2B

COAGULATION
Studies on Natural Water Coagulants in the Sudan, with Special Reference to Moringa Oleifera Seeds,
W79-09844 5F

COASTAL ZONE MANAGEMENT
A Land-Use Planning Model for Coastal Zone Management,
W79-10015 6A

COLIFORM BACTERIA
Fluctuations in Naturally Occurring Populations of Enteric Bacteria in Oligotrophic Streams of Western North Carolina,
W79-09902 5A

COLIFORMS
Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters,
W79-09881 7B

Statistical Interpretation of Membrane Filter Bacteria Counts,
W79-09885 7B

Optimum Membrane Structures for Growth of Fecal Coliform Organisms,
W79-09888 7B

A Comparison of Membrane Filters and Media Used to Recover Coliforms from Water,
W79-09889 7B

Efficiency of Coliform Recovery Using Two Brands of Membrane Filters,
W79-09891 7B

A Layered Membrane Filter Medium for Improved Recovery of Stressed Fecal Coliforms,
W79-09895 7B

Measurement of Fecal Coliforms in Estuarine Water,
W79-09896 7B

Evaluation of Methods for Detecting Coliforms and Fecal Streptococci in Chlorinated Secondary Sewage Effluents,
W79-09897 7B

Critique on ASTM Test for Recovery of Fecal Coliforms and Proposal for Modified Method,
W79-09899 7B

COLORADO
Anthropological Investigations Near the Crest of the Continent, 1975-1978,
W79-09840 6G

COLORADO RIVER BASIN (TX)
Wastewater Management Plan. Colorado River and Tributaries, Texas. Summary,
W79-10020 5G

COMBINED SEWERS
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 7: Combined Sewer Overflow Regulation,
W79-09999 5F

COMPARISON
A Comparative Case Study of Dynamic Models for DO-BOD-Algae Interaction in a Freshwater River,
W79-09862 5A

COMPETING USES
Central Arizona Project RE:CAP, Information Packet No. 3.
W79-10062 5G

COMPREHENSIVE PLANNING
Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study: Summary Report,
W79-09992 5D

Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 1: Planning Criteria,
W79-09993 5G

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 15: Recommended Plan and Implementation Program,
W79-10011 5D

COMPUTER MODELS
A Mathematical Model of Stratified, Bidirectional Flow in Short Culverts,
W79-09835 2A

COMPUTER PROGRAMS
Developing a Computer Program for Distribution System Analysis,
W79-09876 4A

COMPUTERS
The Role of Computers in Transfer of Water Resource Technology,
W79-09853 6A

Computer Applications: A Tool for Water Distribution Engineering,
W79-09875 4A

CONFORMAL MAPPING
Canal Seepage with Boundary at Finite Depth,
W79-09990 2G

CONSERVATION
Analysis of Investments in Technology Development and Resource Conservation,
W79-09854 6B

CONSTRUCTION COSTS
Central Arizona Project RE:CAP, Information Packet No. 2.
W79-10061 6C

Construction Costs for Municipal Wastewater Treatment Plants: 1973-1977.
W79-10080 5D

CONTRACT ADMINISTRATION
Construction Costs for Municipal Wastewater Treatment Plants: 1973-1977.
W79-10080 5D

CONTROL SYSTEMS
Scheduling Trims Back Water Use by 7.3 Inches per Acre,
W79-10070 3F

CORRELATION ANALYSIS
Spatial Correlations of Monthly Rainfall: Applications in Climatology and Weather Modification Experiments,
W79-09964 2B

COST ALLOCATION
Central Arizona Project RE:CAP, Information Packet No. 2.
W79-10061 6C

COST ANALYSIS
Nationwide Cost of Wet-Weather Pollution Control,
W79-09858 6B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 10: Deer Island Wastewater Treatment Plant Analysis and Improvements.
W79-10002 5D

A Comparison of Evaluations of Four Irrigation Projects,
W79-10019 6B

COST COMPARISONS
A Comparison of Evaluations of Four Irrigation Projects,
W79-10019 6B

COST MINIMIZATION
Probabilistic Water Quality Control Policies,
W79-09857 6A

On the Monetary Value of an Ecological River Quality Model,
W79-09863 6A

Procedure for the Economical Evaluation of Water Networks' Parameters,
W79-09866 6A

A Multiobjective Model for Regional Water Quality Management,
W79-09867 6A

Modeling Water Distribution in Santa Clara County, Calif.,
W79-09877 4A

COSTS
Can Off-Peak Pumping Cut Utility Power Costs,
W79-09860 4A

An Analytic Approach to Scheduling Pipe Replacement,
W79-09879 6B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 2: Engineering Criteria,
W79-09994 8B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 5: Land Oriented Wastewater Utilization Concepts,
W79-09998 5G

CROP RESPONSE
Response of Native Grassland Legumes to Water and Nitrogen Treatments,
W79-10071 2I

Irrigation Water Conservation Using Wide-Spaced Furrows,
W79-10074 3F

Salinity Profiles and Leaching Fractions for Slowly Permeable Irrigated Field Soils,
W79-10075 2G

Sprinkler in the Desert,
W79-10079 3F

CRUSTACEANS
Distribution Patterns and Population Dynamics of Polyphemus Pediculus (L.) (Crustacea, Cladocera) in a Small New England Lake,
W79-09836 2H

CULTURES
A Comparison of Membrane Filters and Media Used to Recover Coliforms from Water,
W79-09889 7B

Comparison of Membrane Filters in Recovery of Naturally Injured Coliforms,
W79-09890 7B

Efficiency of Coliform Recovery Using Two Brands of Membrane Filters,
W79-09891 7B

A Comparison of Membrane Filters, Culture Media, Incubation Temperatures, Polluted

CULTURES

Water and Escherichia Coli Strains in the Fecal Coliform Test,
W79-09893 7B

Recovery Characteristics of Bacteria Injured in the Natural Aquatic Environment,
W79-09894 7B

Evaluation of Methods for Detecting Coliforms and Fecal Streptococci in Chlorinated Secondary Sewage Effluents,
W79-09897 7B

The ASTM Proposed Membrane Filter Test Procedure for the Recovery of Fecal Coliforms,
W79-09898 7B

DAMS

Power Production at Federal Dams Could Be Increased by Modernizing Turbines and Generators.
W79-09991 8C

DATA COLLECTIONS

Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 1: Planning Criteria,
W79-09993 5G

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Management Area, EMMA Study, Volume 3B: Study of Wastes from Large Industries,
W79-09995 5B

Wastewater Engineering and Management Study for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 3A: Study of Certain Industrial Wastes.
W79-09996 5B

DECISION MAKING

On the Monetary Value of an Ecological River Quality Model,
W79-09863 6A

Heuristic Decision Rules for Water Resources Planning,
W79-09962 6A

DEEP CREEK (ID)

Autotrophy in Stream Ecosystems,
W79-09922 5C

DELTAS

Application of Infinite Slope Analysis to Subaqueous Sediment Instability, Mississippi Delta,
W79-09970 2L

DEMONSTRATION WATERSHEDS

Can Forest Land Produce Wood, Recreation, and High Quality Water Too,
W79-09851 4C

DEPOSITION (SEDIMENTS)

Experimental Control of Beach Face Dynamics by Watertable Pumping,
W79-09971 2L

DEPTH-AREA-DURATION ANALYSIS

Rainfall in Southern California,
W79-10078 2B

DESALINATION

Pretreatment of Seawater for Reverse Osmosis Processes: 1976,
W79-09831 3A

Long Term Experiments on Sea Water Desalination at the Chigasaki Laboratory,
W79-09871 3A

The World's First Large Seawater Reverse Osmosis Desalination Plant, at Jeddah, Kingdom of Saudi Arabia,
W79-09873 3A

DESALINATION PLANTS

Engineering Management of Nuclear Desalination Plants--A Case Study, Saudi Arabia,
W79-09872 3A

The World's First Large Seawater Reverse Osmosis Desalination Plant, at Jeddah, Kingdom of Saudi Arabia,
W79-09873 3A

Las Palmas Phase II Desalination Plant in the Canary Islands (Spain),
W79-09874 3A

DESALINATION PROCESSES

Process for Scale Control Using Mixtures of Polycationic and Polyanionic Polymers,
W79-10072 3A

DESIGN

Water in a Developing World: The Management of a Critical Resource,
W79-09849 6A

Water Quality Sampling Programs in Rivers,
W79-09859 5A

DESIGN CRITERIA

Optimum Membrane Structures for Growth of Fecal Coliform Organisms,
W79-09888 7B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 2: Engineering Criteria,
W79-09994 8B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 10: Deer Island Wastewater Treatment Plant Analysis and Improvements.
W79-10002 5D

DESIGN FLOOD

Probability Distributions of Best Fit to South African Flood Data,
W79-09842 2E

DESIGN IMPACTS

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13D: Visual, Cultural and Design Impact Analysis,
W79-10009 6B

DEVELOPING COUNTRIES

Environmental Effects of Complex River Development,
W79-09848 4A

Water in a Developing World: The Management of a Critical Resource,
W79-09849 6A

DISINFECTION

Disinfection of Water: Pros and Cons,
W79-09845 5D

DISSOLVED OXYGEN

Probabilistic Water Quality Control Policies,
W79-09857 6A

A Comparative Case Study of Dynamic Models for DO-BOD-Algae Interaction in a Freshwater River,
W79-09862 5A

DISTRIBUTION PATTERNS

Distribution Patterns and Population Dynamics of Polyphemus Pediculus (L.) (Crustacea, Cladocera) in a Small New England Lake,
W79-09836 2H

DITCHES

An Analytical Solution for the Transient Ditch Drainage Problem,
W79-09984 2G

DOMESTIC MODULES

Long Term Experiments on Sea Water Desalination at the Chigasaki Laboratory,
W79-09871 3A

DRAINAGE

Water Requirements and Water Table Variations for a Controlled and Reversible Drainage System,
W79-09966 2G

An Analytical Solution for the Transient Ditch Drainage Problem,
W79-09984 2G

Canal Seepage with Boundary at Finite Depth,
W79-09990 2G

DRAINAGE PRACTICES

Drainage Practice in Imperial Valley,
W79-09910 3C

DREDGING

Pump-Type Sludge Dredging Apparatus,
W79-10017 5E

Dredging and Disposal of Its Large-Volume Waste,
W79-10052 5B

DYNAMIC PROGRAMMING

On the Monetary Value of an Ecological River Quality Model,
W79-09863 6A

E. COLI

Effect of Injury on the Recovery of Indicator Bacteria on Membrane Filters,
W79-09886 7B

Effects of Temperature on the Recovery of Fecal Coliforms,
W79-09887 7B

Comparison of Membrane Filters in Recovery of Naturally Injured Coliforms,
W79-09890 7B

Comparison of Membrane Filter Brands for Recovery of the Coliform Group,
W79-09892 7B

A Comparison of Membrane Filters, Culture Media, Incubation Temperatures, Polluted Water and Escherichia Coli Strains in the Fecal Coliform Test,
W79-09893 7B

Recovery Characteristics of Bacteria Injured in the Natural Aquatic Environment,
W79-09894 7B

ECOLOGY

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13A: Biological Impact Analysis,
W79-10006 6C

Preliminary Observations on the Distribution Abundance and Food Habits of Some Nearshore Fishes in the Northeastern Gulf of Alaska,
W79-10039 5C

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-10047 5C

Avian Community Ecology of the Akulik-Inglutalik River Delta, Norton Bay, Alaska,
W79-10048 5C

ECONOMIC ANALYSIS

Analysis of Investments in Technology Development and Resource Conservation,
W79-09854 6B

An Analytic Approach to Scheduling Pipe Replacement,
W79-09879 6B

ECONOMIC FEASIBILITY
Central Arizona Project RE:CAP, Information Packet No. 2.
W79-10061 6C

Scheduling Trims Back Water Use by 7.3 Inches per Acre,
W79-10070 3F

ECONOMIC IMPACT
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13B: Socio-Economic Impact Analysis,
W79-10007 6B

ECONOMIC JUSTIFICATION
Scheduling Trims Back Water Use by 7.3 Inches per Acre,
W79-10070 3F

ECONOMICS
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13B: Socio-Economic Impact Analysis,
W79-10007 6B

ECOSYSTEMS
Budgets of Selected Natural Mineral Nutrients for a Southeastern Piedmont Forest and Pasture,
W79-09927 5C

Biostimulants,
W79-10057 5C

Biological Effects - A Generic View,
W79-10059 5C

EFFECTS
Income Distribution Impacts of a Water Development Project--Boise Project, Idaho, 1950-1970,
W79-09865 6B

An Analytic Approach to Scheduling Pipe Replacement,
W79-09879 6B

EFFICIENCIES
Power Production at Federal Dams Could Be Increased by Modernizing Turbines and Generators.
W79-09991 8C

EFFLUENT STANDARDS
A Multiobjective Model for Regional Water Quality Management,
W79-09867 6A

EFFLUENTS
Analysis of Nitrate Content of Surface Water and Effluent Water. Applications of a Plastic-Membrane Nitrate-Selective Electrode in Water Quality Monitors,
W79-09920 5C

ELECTRIC POWER
Can Off-Peak Pumping Cut Utility Power Costs,
W79-09860 4A

ELECTRODES
Analysis of Nitrate Content of Surface Water and Effluent Water. Applications of a Plastic-Membrane Nitrate-Selective Electrode in Water Quality Monitors,
W79-09920 5C

ENERGY
What Price, Reject Heat,
W79-09868 6C

ENERGY CONSERVATION
Central Arizona Project RE:CAP, Information Packet No. 4.
W79-10063 8A

ENGINEERING
Computer Applications: A Tool for Water Distribution Engineering,
W79-09875 4A

ENGINEERING MANAGEMENT
Engineering Management of Nuclear Desalination Plants--A Case Study, Saudi Arabia,
W79-09872 3A

ENGINEERING STRUCTURES
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 15: Recommended Plan and Implementation Program,
W79-10011 5D

ENGLAND
Lagoon Recharge of the Folkestone Beds at Hardham, Sussex--1972-75,
W79-09988 4B

ENVIRONMENT
Environmental Quality and River Basin Development: A Model for Integrated Analysis and Planning,
W79-09850 6A

ENVIRONMENTAL EFFECTS
Environmental Effects of Complex River Development,
W79-09848 4A

Recovery Characteristics of Bacteria Injured in the Natural Aquatic Environment,
W79-09894 7B

Effect of Selenium Dioxide on the Accumulation and Acute Toxicity of Mercuric Chloride in Goldfish,
W79-09901 5C

The Effect of Temperature on Copper Tolerance of Paramecium,
W79-09903 5C

A Morphological Defect in Shiner Perch Resulting from Chronic Exposure to Chlorinated Sea Water,
W79-09907 5C

Effects of Temperature and Cold Storage on Development Time and Viability of Eggs of the Burrowing Mayfly Hexagenia Rigida (Ephemeroptera: Ephemeridae),
W79-09919 5C

Effects of Calcium Addition as Ca(NO3)2 on Zinc Toxicity to Fathead Minnows, Pimephales Promelas, Rafinesque,
W79-09928 5C

Reduction of Blood Plasma Copper Concentrations in a Marine Fish Following a Six Month Exposure to Crude Oil,
W79-09931 5C

Influences of Hardness Constituents on the Acute Toxicity of Cadmium to Brook Trout (Salvelinus Fontinalis),
W79-09932 5C

Trace Metal Uptake by Three Species of Mollusks,
W79-09933 5C

Laboratory Studies on the Direct Effect of Temperature on the Freshwater Vector Snail, Indoplanorbis Exustus (Deshyes),
W79-09934 5C

Mercury Contamination of Fish in Guatemala,
W79-09939 5C

The Development of the Eggs and Early Larvae of Blue Whiting, Micromeisistius Poutassou, and the Effect of Temperature on Development,
W79-09942 5C

An Investigation of Plutonium Concentration and Distribution in a Burrowing Crayfish from the White Oak Creek Floodplain,
W79-09943 5C

An Empirical Model of Impingement Impact,
W79-09944 5C

Thermal Behavioral Responses of the Speckled Sanddab, Citharichthys Stigmaeus: Laboratory and Field Investigations,
W79-09945 5C

Thermal Behavioral Responses of Selected California Littoral Fishes,
W79-09946 5C

Effects of Sudden Temperature Shifts on Pure Cultures of Four Strains of Freshwater Bacteria,
W79-09948 5C

Effect of a Steam Electric Generating Station on the Emergence Timing of the Mayfly, Hexagenia Bileneata,
W79-09949 5C

The Freshwater Littoral Meiofauna in a South Carolina Reservoir Receiving Thermal Effluents,
W79-09950 5C

Growth, Feeding and Mortality of Larval and Early Postlarval Stages of the Oceanic Shrimp Sergestes Similis Hansen,
W79-09951 5C

The Effects of Temperature and Different Food Organisms on the Rate of Gastric Evacuation in Perch (Perca Fluviatilis),
W79-09952 5C

The Influence of Some Ecological Factors on the Metabolism-Temperature Curve of the Larvae of Limnephilus Rhombicus, (Trichoptera, Limnephilidae),
W79-09953 5C

Effects of Water-Soluble Chlorine-Containing Organics on Aquatic Environments--Another Perspective.
W79-09954 5C

Upper Limits of the Depth Range and Temperature Tolerance of the Baltic Pontoporeia Affinis (Crustacea, Amphipoda),
W79-09956 5C

Changes in the Aquatic Flora Along a Stretch of the River Umealven, N. Sweden, Following Hydroelectric Exploitation,
W79-09957 5C

Toxicity of Gallium and Beryllium to Developing Carp Eggs (Cyprinus Carpio) Utilizing Copper as a Reference.
W79-09958 5C

Factors Affecting the Burrowing Activity of Macoma Balthica (L.),
W79-09959 5C

Effects of Artificial Rise of Temperature on Stagnant Waters and Their Biocenoses.
W79-09960 5C

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13A: Biological Impact Analysis,
W79-10006 6C

Central Arizona Project RE:CAP, Information Packet No. 5.
W79-10064 6G

Aspects of Environmental Health Impacts of the Aswan High Dam on Rural Population in Egypt,
W79-10066 6G

Nitrate Levels in Groundwater from the Fleuve, Senegal,
W79-10067 5A

Response of Native Grassland Legumes to Water and Nitrogen Treatments,
W79-10071 2I

Boron Distribution in Soils and Waters of Egypt,
W79-10073 2K

Irrigation Water Conservation Using Wide-Spaced Furrows,
W79-10074 3F

ENVIRONMENTAL SANITATION
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13C: Hygienic Impact Analysis,
W79-10008 5F

EQUITABLE APPORTIONMENT
Central Arizona Project RE:CAP, Information Packet No. 3.
W79-10062 5G

EROSION
Consequences of Harvesting and Site Preparation in the Piedmont,
W79-09878 5A

EROSION CONTROL
Consequences of Harvesting and Site Preparation in the Piedmont,
W79-09878 5A

ESTIMATING
Construction Costs for Municipal Wastewater Treatment Plants: 1973-1977.
W79-10080 5D

ESTIMATING EQUATIONS
The Prediction of Mean Monthly Soil Temperature from Mean Monthly Air Temperature,
W79-09906 2A

EUTROPHICATION
The Chemical Composition of the Upper Hennops River and its Implications on the Water Quality of Rietvlei Dam,
W79-09843 5A

Distribution of Phytoplankton in Louisiana Lakes,
W79-10026 2H

Distribution of Phytoplankton in South Dakota Lakes,
W79-10027 2H

EVALUATION
Water in a Developing World: The Management of a Critical Resource,
W79-09849 6A

Comparative Evaluation of Statistical Methods for Water Supply Forecasting,
W79-09870 2E

Comparison of Membrane Filters in Recovery of Naturally Injured Coliforms,
W79-09890 7B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13: Impact Analysis and Evaluation,
W79-10005 6G

EVAPOTRANSPIRATION
The Role of Evapotranspiration Models in Irrigation Scheduling,
W79-09914 2D

EVERGLADES AGRICULTURAL AREA
Subsidence Related to Land Use in Everglades Agricultural Area,
W79-09968 4A

EXPANSIVE CLAYS
Engineering Problems Associated with Expansive Clays from Romania,
W79-09972 2G

FABRICATION
Performance Variability of Membrane Filter Procedures,
W79-09883 7B

Quality Control of Membrane Filter Media,
W79-09884 7B

FACILITIES
Water Factory 21 Design and Operating Data,
W79-09961 5D

FACILITIES PLANNING
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 15: Recommended Plan and Implementation Program,
W79-10011 5D

FARM WASTES
Infiltration of Liquid Dairy Manure into Soil,
W79-09965 5E

FEASIBILITY STUDIES
A Comparison of Evaluations of Four Irrigation Projects,
W79-10019 6B

FEDERAL WATER POLLUTION CONTROL ACT
Market Models for Water Pollution Control: Their Strengths and Weaknesses,
W79-10016 6E

FIELD DATA
A Comparative Case Study of Dynamic Models for DO-BOD-Algae Interaction in a Freshwater River,
W79-09862 5A

FILMS
Development of Dry Process Microporous Polysulfone Supports for Ultrathin Film Composites,
W79-09839 3A

FILTERS
Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters,
W79-09881 7B

Quality Control of Membrane Filter Media,
W79-09884 7B

A Comparison of Membrane Filters and Media Used to Recover Coliforms from Water,
W79-09889 7B

Efficiency of Coliform Recovery Using Two Brands of Membrane Filters,
W79-09891 7B

Comparison of Membrane Filter Brands for Recovery of the Coliform Group,
W79-09892 7B

A Comparison of Membrane Filters, Culture Media, Incubation Temperatures, Polluted Water and Escherichia Coli Strains in the Fecal Coliform Test,
W79-09893 7B

The ASTM Proposed Membrane Filter Test Procedure for the Recovery of Fecal Coliforms,
W79-09898 7B

Critique on ASTM Test for Recovery of Fecal Coliforms and Proposal for Modified Method,
W79-09899 7B

FILTRATION
The Membrane Filter Dilemma,
W79-09882 7B

Performance Variability of Membrane Filter Procedures,
W79-09883 7B

Effects of Temperature on the Recovery of Fecal Coliforms,
W79-09887 7B

Water Control and Distribution Apparatus,
W79-10032 5G

FINANCING
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts, EMMA Study, Volume 12: Financing and Management, Parts 1 and 2,
W79-10004 6E

FINFISH
Finfish Resource Surveys in Norton Sound and Kotzebue Sound,
W79-10034 5C

FISHERIES
Baseline Studies of the Demersal Resources of the Eastern and Western Gulf of Alaska Shelf and Slope: A Historical Review,
W79-10037 5C

Beaufort Sea Estuarine Fishery Study,
W79-10038 5C

Preliminary Observations on the Distribution Abundance and Food Habits of Some Nearshore Fishes in the Northeastern Gulf of Alaska,
W79-10039 5C

FLOOD DATA
Flood Plain Information: Pojoaque River and Tributaries, Santa Fe County, New Mexico,
W79-10012 2E

Flood Hazard Analyses, Worthley Brook, Town of Poland, Maine, Androscoggin County,
W79-10014 2E

FLOOD FORECASTING
Probability Distributions of Best Fit to South African Flood Data,
W79-09842 2E

FLOOD PLAINS
Flood Plain Information: Pojoaque River and Tributaries, Santa Fe County, New Mexico,
W79-10012 2E

Flood Plain Information: Mimbres River and Florida Gap Draw, Deming, Luna County, NM.
W79-10013 2E

FLOOD PROFILES
Probability Distributions of Best Fit to South African Flood Data,
W79-09842 2E

Flood Plain Information: Pojoaque River and Tributaries, Santa Fe County, New Mexico,
W79-10012 2E

Flood Plain Information: Mimbres River and Florida Gap Draw, Deming, Luna County, NM.
W79-10013 2E

FLOOD STAGES
Flood Plain Information: Pojoaque River and Tributaries, Santa Fe County, New Mexico,
W79-10012 2E

Flood Hazard Analyses, Worthley Brook, Town of Poland, Maine, Androscoggin County,
W79-10014 2E

FLOODING
Flood Plain Information: Pojoaque River and Tributaries, Santa Fe County, New Mexico,
W79-10012 2E

Flood Plain Information: Mimbres River and Florida Gap Draw, Deming, Luna County, NM.
W79-10013 2E

FLOODS
Flood Hazard Analyses, Worthley Brook, Town of Poland, Maine, Androscoggin County,
W79-10014 2E

FLORIDA
Subsidence Related to Land Use in Everglades Agricultural Area,
W79-09968 4A

FLORIDA GAP DRAW (NM)
Flood Plain Information: Mimbres River and Florida Gap Draw, Deming, Luna County, NM.
W79-10013 2E

FLOW
Flow Monitoring,
W79-09936 8B

FLOW AUGMENTATION
State of the Art in Managing Water Resources on Forest Land,
W79-09880 3B

FLOW CONTROL
Multiple Emitter Flow Control,
W79-10018 3F

FLOW DURATION
State of the Art in Managing Water Resources on Forest Land,
W79-09880 3B

FOLKESTONE BEDS (ENGLAND)
Lagoon Recharge of the Folkestone Beds at Hardham, Sussex--1972-75,
W79-09988 4B

FORECASTING
Comparative Evaluation of Statistical Methods for Water Supply Forecasting,
W79-09870 2E

An Analytic Approach to Scheduling Pipe Replacement,
W79-09879 6B

FOREST FERTILIZATION
Some Effects of Urea Fertilization on a Forested Watershed in West Virginia,
W79-09847 2K

FOREST PRACTICES
Consequences of Harvesting and Site Preparation in the Piedmont,
W79-09878 5A

FOREST WATERSHEDS
Budgets of Selected Natural Mineral Nutrients for a Southeastern Piedmont Forest and Pasture,
W79-09927 5C

FORESTED WATERSHED
State of the Art in Managing Water Resources on Forest Land,
W79-09880 3B

FORESTRY
Can Forest Land Produce Wood, Recreation, and High Quality Water Too,
W79-09851 4C

FOSSIL FUELS
Fossil Fuel Compounds,
W79-10058 5C

FRESHWATER
A Comparative Case Study of Dynamic Models for DO-BOD-Algae Interaction in a Freshwater River,
W79-09862 5A

FUNGI
Comparison of Membrane Filter Counts and Plate Counts on Heterotrophic and Oil Agar Used to Estimate Populations of Yeast, Fungi and Bacteria,
W79-09900 7B

FURROW IRRIGATION
Intake Characteristics of Irrigation Furrows,
W79-09909 2G

Irrigation Water Conservation Using Wide-Spaced Furrows,
W79-10074 3F

GEOLOGIC HISTORY
Mid-Eocene Climatic Change, Southwestern California and Northwestern Baja California,
W79-10076 2B

GEOMETRIC PROGRAMMING
Procedure for the Economical Evaluation of Water Networks' Parameters,
W79-09866 6A

GEOMORPHOLOGY
Water Quality Characteristics of the Horse Creek Watersheds in North Central Idaho,
W79-09838 2A

GEORGIA
Spatial Correlations of Monthly Rainfall: Applications in Climatology and Weather Modification Experiments,
W79-09964 2B

GLACIAL DRIFT
The Formation of Medial Moraines on Alpine Glaciers,
W79-09973 2C

GLACIATION
Pattern of Ice Surface Lowering for Rennick Glacier, Northern Victoria Land, Antarctica,
W79-09974 2C

GLACIERS
The Formation of Medial Moraines on Alpine Glaciers,
W79-09973 2C

Pattern of Ice Surface Lowering for Rennick Glacier, Northern Victoria Land, Antarctica,
W79-09974 2C

GOAL PROGRAMMING
A Multiobjective Model for Regional Water Quality Management,
W79-09867 6A

GREENHOUSES
What Price, Reject Heat,
W79-09868 6C

GROUNDWATER
Use of Baker's Yeast to Trace Microbial Movements in Ground Water,
W79-09855 5B

Nitrogen-Isotope Ratio Studies of Soils and Groundwater Nitrate from Alluvial Fan Aquifers in Texas,
W79-09983 5B

Fertilizer Nitrogen Distribution Under Irrigation Between Soil, Plant, and Aquifer,
W79-10024 4B

GROUNDWATER RESOURCES
Central Arizona Project RE:CAP, Information Packet No. 4.
W79-10063 8A

GROWTH RATES
Recovery Characteristics of Bacteria Injured in the Natural Aquatic Environment,
W79-09894 7B

HEADWORKS
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Volume 9: MDC Interceptor and Pumping Station Analysis and Improvements.
W79-10001 8B

HEAVY METALS
Acute Toxicity of Heavy Metals,
W79-10041 5C

Metabolism of Trace Metals: Bioaccumulation and Biotransformation in Marine Organisms,
W79-10043 5C

Behavioral and Physiological Effects Induced by Sublethal Levels of Heavy Metals,
W79-10044 5C

General Effects of Metals on the Ecosystem,
W79-10045 5C

Trace Metals,
W79-10056 5C

HERBICIDES
Low Picloram Concentrations in Streamflow Resulting from Forest Application of Tordon-10K,
W79-09864 5B

HETEROTROPHY
Fluctuations in Naturally Occurring Populations of Enteric Bacteria in Oligotrophic Streams of Western North Carolina,
W79-09902 5A

HEURISTICS
Heuristic Decision Rules for Water Resources Planning,
W79-09962 6A

HISTORIC FLOODS
Flood Hazard Analyses, Worthley Brook, Town of Poland, Maine, Androscoggin County,
W79-10014 2E

HISTORY
Anthropological Investigations Near the Crest of the Continent, 1975-1978,
W79-09840 6G

HUMAN DISEASES
Aspects of Environmental Health Impacts of the Aswan High Dam on Rural Population in Egypt,
W79-10066 6G

Nitrate Levels in Groundwater from the Fleuve, Senegal,
W79-10067 5A

HYDRAULIC CONDUCTIVITY
A Study of the Permanent Effects of Elevated Temperature on the Hydraulic Properties of Clay,
W79-10022 8B

HYDROELECTRIC PLANTS
Changes in the Aquatic Flora Along a Stretch of the River Umealven, N. Sweden, Following Hydroelectric Exploitation,
W79-09957 5C

HYDROELECTRIC POWER
Power Production at Federal Dams Could Be Increased by Modernizing Turbines and Generators.
W79-09991 8C

HYDROLOGIC DATA
Comparative Evaluation of Statistical Methods for Water Supply Forecasting,
W79-09870 2E

HYDROLOGIC MODELS
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 7: Combined Sewer Overflow Regulation,
W79-09999 5F

IDAHO
Income Distribution Impacts of a Water Development Project--Boise Project, Idaho, 1950-1970,
W79-09865 6B

ILLINOIS
Elements of a Water Quality Information System for the State of Illinois,
W79-09869 5A

IMPACT ANALYSIS
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13: Impact Analysis and Evaluation,
W79-10005 6G

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13D: Visual, Cultural and Design Impact Analysis,
W79-10009 6B

IMPLEMENTATION
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 15: Recommended Plan and Implementation Program,
W79-10011 5D

INCOME DISTRIBUTION
Income Distribution Impacts of a Water Development Project--Boise Project, Idaho, 1950-1970,
W79-09865 6B

INCOME GROWTH
Income Distribution Impacts of a Water Development Project--Boise Project, Idaho, 1950-1970,
W79-09865 6B

INDUSTRIAL WASTES
Process and Apparatus for Separating Matter in Suspension in a Liquid,
W79-09941 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Management Area, EMMA Study, Volume 3B: Study of Wastes from Large Industries,
W79-09995 5B

Wastewater Engineering and Management Study for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 3A: Study of Certain Industrial Wastes.
W79-09996 5B

INFILTRATION
Infiltration of Liquid Dairy Manure into Soil,
W79-09965 5E

Simulation of Infiltration from a Continuous and an Intermittent Subsurface Source,
W79-09978 2G

Infiltration as Influenced by Irrigation Water Quality,
W79-09989 5C

INFILTRATION RATES
Intake Characteristics of Irrigation Furrows,
W79-09909 2G

INFORMATION SYSTEM
Elements of a Water Quality Information System for the State of Illinois,
W79-09869 5A

INSTITUTIONS
Water in a Developing World: The Management of a Critical Resource,
W79-09849 6A

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts, EMMA Study, Volume 12: Financing and Management, Parts 1 and 2,
W79-10004 6E

INTERCEPTOR SEWERS
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Volume 9: MDC Interceptor and Pumping Station Analysis and Improvements.
W79-10001 8B

INTERTIDAL AREAS
Intertidal Biota and Subtidal Kelp Communities of the Kodiak Island Area,
W79-10035 5C

Sorting and Identification of Intertidal Samples,
W79-10036 5C

INVERTEBRATES
Distribution and Abundance of Some Epibenthic Invertebrates of the Northeastern Gulf of Alaska with Notes on the Feeding Biology of Selected Species,
W79-10033 5C

INVESTMENT
Analysis of Investments in Technology Development and Resource Conservation,
W79-09854 6B

ION EXCHANGE
Exchange of Certain Radionuclides Between the Environment and Fresh-Water Algae,
W79-09923 5C

IRRIGATED AGRICULTURE
The Economic Value of Irrigation Water in the Western United States,
W79-10023 6B

IRRIGATION
Time of Spread Relationship in Irrigation Check Basins,
W79-09917 2G

Water Requirements and Water Table Variations for a Controlled and Reversible Drainage System,
W79-09966 2G

Traveling Boom Sprinkler Operation in Wind,
W79-09967 3F

Multiple Emitter Flow Control,
W79-10018 3F

IRRIGATION EFFICIENCY
Salinity Profiles and Leaching Fractions for Slowly Permeable Irrigated Field Soils,
W79-10075 2G

Sprinkler in the Desert,
W79-10079 3F

IRRIGATION PRACTICES
Minimizing the Salt Burden of Irrigation Drainage Water in the Pecos Valley of New Mexico.
W79-09837 3B

Traveling Boom Sprinkler Operation in Wind,
W79-09967 3F

Scheduling Trims Back Water Use by 7.3 Inches per Acre,
W79-10070 3F

Irrigation Water Conservation Using Wide-Spaced Furrows,
W79-10074 3F

Sprinkler in the Desert,
W79-10079 3F

IRRIGATION PROJECTS
A Comparison of Evaluations of Four Irrigation Projects,
W79-10019 6B

IRRIGATION SCHEDULING
The Role of Evapotranspiration Models in Irrigation Scheduling,
W79-09914 2D

IRRIGATION SYSTEMS
Sprinkler in the Desert,
W79-10079 3F

IRRIGATION WATER
A Study of the Reuse of Reused Water,
W79-09846 3C

Infiltration as Influenced by Irrigation Water Quality,
W79-09989 5C

ISOQUANTS
Nationwide Cost of Wet-Weather Pollution Control,
W79-09858 6B

ISOTOPES (STABLE)
Nitrogen-Isotope Ratio Studies of Soils and Groundwater Nitrate from Alluvial Fan Aquifers in Texas,
W79-09983 5B

JEDDAH (SAUDI ARABIA)
The World's First Large Seawater Reverse Osmosis Desalination Plant, at Jeddah, Kingdom of Saudi Arabia,
W79-09873 3A

KNOWLEDGE
The Role of Computers in Transfer of Water Resource Technology,
W79-09853 6A

LABORATORY TESTS
Water Analysis in South Africa: Interlaboratory Comparison Studies, Part IV: Mineral Analysis,
W79-09841 9C

Chlorophenols in Surface Waters of the Netherlands (1976-1977),
W79-09987 5A

LAKES
A Study of the Reuse of Reused Water,
W79-09846 3C

Regulation Model of the Lake Velence Reservoir System,
W79-09852 6A

Uncertainty Analysis Applied to Vollenweider's Phosphorus Loading Criterion,
W79-09856 5A

LAND APPLICATION
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 5: Land Oriented Wastewater Utilization Concepts,
W79-09998 5G

LAND SUBSIDENCE
Subsidence Related to Land Use in Everglades Agricultural Area,
W79-09968 4A

LAND TREATMENT
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Met-

ropolitan Area, EMMA Study, Technical Data Volume 5: Land Oriented Wastewater Utilization Concepts,
W79-09998 5G

LAND USE
Inputs and Outputs of Water and Phosphorus from Four Victoria Catchments,
W79-09921 5B

Subsidence Related to Land Use in Everglades Agricultural Area,
W79-09968 4A

A Land-Use Planning Model for Coastal Zone Management,
W79-10015 6A

LEACHING
Minimizing the Salt Burden of Irrigation Drainage Water in the Pecos Valley of New Mexico.
W79-09837 3B

Nitrogen and Chloride Leaching in a Sandy Field Plot,
W79-09911 2G

Salinity Profiles and Leaching Fractions for Slowly Permeable Irrigated Field Soils,
W79-10075 2G

LEGUMES
Response of Native Grassland Legumes to Water and Nitrogen Treatments,
W79-10071 2I

LINEAR PROGRAMMING
A Land-Use Planning Model for Coastal Zone Management,
W79-10015 6A

LOADING
Uncertainty Analysis Applied to Vollenweider's Phosphorus Loading Criterion,
W79-09856 5A

LOSS MINIMIZATION
Regulation Model of the Lake Velence Reservoir System,
W79-09852 6A

LOUISIANA
Distribution of Phytoplankton in Louisiana Lakes,
W79-10026 2H

LUBBOCK CANYON LAKES
A Study of the Reuse of Reused Water,
W79-09846 3C

LUBBOCK (TX)
A Study of the Reuse of Reused Water,
W79-09846 3C

LUNA COUNTY (NM)
Flood Plain Information: Mimbres River and Florida Gap Draw, Deming, Luna County, NM.
W79-10013 2E

MACROPHYTES
The Distribution and Seasonality of the Benthic Aquatic Macrophytes of the Pamlico River Estuary, North Carolina,
W79-09834 2L

MAGNESIUM
Magnesium Uptake from Exchangeable and Nonexchangeable Sources in Soils as Measured by Intensive Cropping,
W79-09908 2I

MAINE
Flood Hazard Analyses, Worthley Brook, Town of Poland, Maine, Androscoggin County,
W79-10014 2E

MANAGEMENT
Water in a Developing World: The Management of a Critical Resource,
W79-09849 6A

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 8: Urban Stormwater Management,
W79-10000 5F

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts, EMMA Study, Volume 12: Financing and Management, Parts 1 and 2,
W79-10004 6E

MANPOWER
Engineering Management of Nuclear Desalination Plants--A Case Study, Saudi Arabia,
W79-09872 3A

MARINE BACTERIA
Comparison of Membrane Filter Counts and Plate Counts on Heterotrophic and Oil Agar Used to Estimate Populations of Yeast, Fungi and Bacteria,
W79-09900 7B

MASSACHUSETTS
Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study: Summary Report,
W79-09992 5D

Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 1: Planning Criteria,
W79-09993 5G

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 2: Engineering Criteria,
W79-09994 8B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Management Area, EMMA Study, Volume 3B: Study of Wastes from Large Industries,
W79-09995 5B

Wastewater Engineering and Management Study for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 3A: Study of Certain Industrial Wastes.
W79-09996 5B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 4: Water Oriented Wastewater Disposal Concepts,
W79-09997 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 5: Land Oriented Wastewater Utilization Concepts,
W79-09998 5G

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 7: Combined Sewer Overflow Regulation,
W79-09999 5F

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 8: Urban Stormwater Management,
W79-10000 5F

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Volume 9: MDC Interceptor and Pumping Station Analysis and Improvements.
W79-10001 8B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 10: Deer Island Wastewater Treatment Plant Analysis and Improvements.
W79-10002 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 11: Nut Island Wastewater Treatment Plant Analysis and Improvements.
W79-10003 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts, EMMA Study, Volume 12: Financing and Management, Parts 1 and 2,
W79-10004 6E

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13: Impact Analysis and Evaluation,
W79-10005 6G

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13A: Biological Impact Analysis,
W79-10006 6C

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13B: Socio-Economic Impact Analysis,
W79-10007 6B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13C: Hygienic Impact Analysis,
W79-10008 5F

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13D: Visual, Cultural and Design Impact Analysis,
W79-10009 6B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 14: Public Involvement,
W79-10010 6B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 15: Recommended Plan and Implementation Program.
W79-10011 5D

MATERIAL TESTING
Efficiency of Coliform Recovery Using Two Brands of Membrane Filters,
W79-09891 7B

MATERIALS TESTING
Quality Control of Membrane Filter Media.
W79-09884 7B

MATHEMATICAL MODELS
Probability Distributions of Best Fit to South African Flood Data,
W79-09842 2E

Comparative Evaluation of Statistical Methods for Water Supply Forecasting.
W79-09870 2E

A Land-Use Planning Model for Coastal Zone Management,
W79-10015 6A

MEASUREMENT
Flow Monitoring,
W79-09936 8B

MEIOFAUNA
An Ecophysiological Study of the Meiofauna of the Swartkops Estuary. 3. Partition of Benthic Oxygen Consumption and the Relative Importance of the Meiofauna,
W79-09924 5C

MEMBRANE PROCESSES
Pretreatment of Seawater for Reverse Osmosis Processes: 1976,
W79-09831 3A

Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters,
W79-09881 7B

The Membrane Filter Dilemma,
W79-09882 7B

Performance Variability of Membrane Filter Procedures,
W79-09883 7B

A Layered Membrane Filter Medium for Improved Recovery of Stressed Fecal Coliforms,
W79-09895 7B

Measurement of Fecal Coliforms in Estuarine Water,
W79-09896 7B

Evaluation of Methods for Detecting Coliforms and Fecal Streptococci in Chlorinated Secondary Sewage Effluents,
W79-09897 7B

The ASTM Proposed Membrane Filter Test Procedure for the Recovery of Fecal Coliforms,
W79-09898 7B

MEMBRANES
Development of Dry Process Microporous Polysulfone Supports for Ultrathin Film Composites,
W79-09839 3A

Proceedings of the Symposium on the Recovery of Indicator Organisms Employing Membrane Filters,
W79-09881 7B

The Membrane Filter Dilemma,
W79-09882 7B

Quality Control of Membrane Filter Media,
W79-09884 7B

Statistical Interpretation of Membrane Filter Bacteria Counts,
W79-09885 7B

Effect of Injury on the Recovery of Indicator Bacteria on Membrane Filters,
W79-09886 7B

Effects of Temperature on the Recovery of Fecal Coliforms,
W79-09887 7B

Optimum Membrane Structures for Growth of Fecal Coliform Organisms,
W79-09888 7B

A Comparison of Membrane Filters and Media Used to Recover Coliforms from Water,
W79-09889 7B

Comparison of Membrane Filters in Recovery of Naturally Injured Coliforms,
W79-09890 7B

Efficiency of Coliform Recovery Using Two Brands of Membrane Filters,
W79-09891 7B

Comparison of Membrane Filter Brands for Recovery of the Coliform Group,
W79-09892 7B

A Comparison of Membrane Filters, Culture Media, Incubation Temperatures, Polluted Water and Escherichia Coli Strains in the Fecal Coliform Test,
W79-09893 7B

Measurement of Fecal Coliforms in Estuarine Water,
W79-09896 7B

Critique on ASTM Test for Recovery of Fecal Coliforms and Proposal for Modified Method,
W79-09899 7B

Comparison of Membrane Filter Counts and Plate Counts on Heterotrophic and Oil Agar Used to Estimate Populations of Yeast, Fungi and Bacteria,
W79-09900 7B

Analysis of Nitrate Content of Surface Water and Effluent Water. Applications of a Plastic-Membrane Nitrate-Selective Electrode in Water Quality Monitors,
W79-09920 5C

MERCURY
Soil Water Content and Temperature as Factors in the Volatile Loss of Applied Mercury (II) from Soils,
W79-09916 2K

METABOLISM
The Influence of Some Ecological Factors on the Metabolism-Temperature Curve of the Larvae of Limnephilus Rhombicus, (Trichoptera, Limnephilidae),
W79-09953 5C

Metabolism of Trace Metals: Bioaccumulation and Biotransformation in Marine Organisms,
W79-10043 5C

METALIMNION
Reservoir Metalimnion Oxygen Demands: Discussion,
W79-09925 5C

METALS
Levels and Sources of Critical Trace Metals in the Marine Environment,
W79-10040 5B

Pathology of Arctic and Subarctic Marine Species and Exposure to Trace Metals Associated with Petroleum,
W79-10042 5C

Trace Metals,
W79-10056 5C

METHODOLOGY
Environmental Quality and River Basin Development: A Model for Integrated Analysis and Planning,
W79-09850 6A

Analysis of Investments in Technology Development and Resource Conservation,
W79-09854 6B

Nationwide Cost of Wet-Weather Pollution Control,
W79-09858 6B

Water Quality Sampling Programs in Rivers,
W79-09859 5A

Heuristic Decision Rules for Water Resources Planning,
W79-09962 6A

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 14: Public Involvement,
W79-10010 6B

MEUSE RIVER
Chlorophenols in Surface Waters of the Netherlands (1976-1977),
W79-09987 5A

MICROBIAL MOVEMENT
Use of Baker's Yeast to Trace Microbial Movements in Ground Water,
W79-09855 5B

MICROORGANISMS
A Direct Observation Technique for the Study of Microorganisms in Sediment Samples,
W79-09982 2J

Microorganisms,
W79-10055 5C

MICROSCOPY
A Direct Observation Technique for the Study of Microorganisms in Sediment Samples,
W79-09982 2J

MIGRATION
Migration of Birds in Alaska Marine Habitats,
W79-10046 5C

MIMBRES RIVER (NM)
Flood Plain Information: Mimbres River and Florida Gap Draw, Deming, Luna County, NM.
W79-10013 2E

MISSISSIPPI RIVER
Application of Infinite Slope Analysis to Subaqueous Sediment Instability, Mississippi Delta,
W79-09970 2L

MODEL STUDIES
A Comparative Case Study of Dynamic Models for DO-BOD-Algae Interaction in a Freshwater River,
W79-09862 5A

User's Manual for Agricultural Runoff Management (ARM) Model,
W79-09904 5G

The Role of Evapotranspiration Models in Irrigation Scheduling,
W79-09914 2D

An Empirical Model of Impingement Impact,
W79-09944 5C

Computer Simulation Model for Predicting Soil Water Content Profiles,
W79-09977 2G

Simulation of Infiltration from a Continuous and an Intermittent Subsurface Source,
W79-09978 2G

Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 1: Planning Criteria,
W79-09993 5G

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Volume 9: MDC Interceptor and Pumping Station Analysis and Improvements.
W79-10001 8B

MOISTURE AVAILABILITY
Response of Native Grassland Legumes to Water and Nitrogen Treatments,
W79-10071 2I

MOISTURE CONTENT
Soil Water Content and Temperature as Factors in the Volatile Loss of Applied Mercury (II) from Soils,
W79-09916 2K

MONITORING
Analysis of Nitrate Content of Surface Water and Effluent Water. Applications of a Plastic-Membrane Nitrate-Selective Electrode in Water Quality Monitors,
W79-09920 5C

Electrochemical Determination of Heavy Metals in Water and Apparatus Therefor,
W79-09935 5A

Flow Monitoring,
W79-09936 8B

Monitoring the Temporal Dispersion of a Sewage Sludge Plume,
W79-10030 5C

Litter,
W79-10053 5B

Microorganisms,
W79-10055 5C

Biological Effects - A Generic View,
W79-10059 5C

MULTIOBJECTIVES
A Multiobjective Model for Regional Water Quality Management,
W79-09867 6A

MULTIPLE PURPOSE PROJECTS
Central Arizona Project RE:CAP, Information Packet No. 1.
W79-10060 8A

NASSAU COUNTY (NY)
A Land-Use Planning Model for Coastal Zone Management,
W79-10015 6A

NEMATODES
An Ecophysiological Study of the Meiofauna of the Swartkops Estuary. 3. Partition of Benthic Oxygen Consumption and the Relative Importance of the Meiofauna,
W79-09924 5C

NETWORKS
Procedure for the Economical Evaluation of Water Networks' Parameters,
W79-09866 6A

Developing a Computer Program for Distribution System Analysis,
W79-09876 4A

NEW MEXICO
Flood Plain Information: Pojoaque River and Tributaries, Santa Fe County, New Mexico,
W79-10012 2E

Flood Plain Information: Mimbres River and Florida Gap Draw, Deming, Luna County, NM.
W79-10013 2E

NEW YORK BIGHT
Monitoring the Temporal Dispersion of a Sewage Sludge Plume,
W79-10030 5C

NITRATES
Analysis of Nitrate Content of Surface Water and Effluent Water. Applications of a Plastic-Membrane Nitrate-Selective Electrode in Water Quality Monitors,
W79-09920 5C

Nitrogen-Isotope Ratio Studies of Soils and Groundwater Nitrate from Alluvial Fan Aquifers in Texas,
W79-09983 5B

NITRILOTRIACETIC ACID
Concentrations of Nitrilotriacetate and Certain Metals in Canadian Wastewaters and Streams: 1971-1975,
W79-09986 5B

NITROGEN
Nitrogen and Chloride Leaching in a Sandy Field Plot,
W79-09911 2G

Nitrogen-Isotope Ratio Studies of Soils and Groundwater Nitrate from Alluvial Fan Aquifers in Texas,
W79-09983 5B

NITROGEN CYCLE
Response of Native Grassland Legumes to Water and Nitrogen Treatments,
W79-10071 2I

NITROGEN FERTILIZERS
Fertilizer Nitrogen Distribution Under Irrigation Between Soil, Plant, and Aquifer,
W79-10024 4B

NITROGEN FIXATION
Response of Native Grassland Legumes to Water and Nitrogen Treatments,
W79-10071 2I

NORWAY
Methodology of Studies on Chemical Processes in Water Runoff from Rock and Shallow Soil Cover Using Radioactive Tracers,
W79-09980 2K

Interaction Between Simulated Rain and Barren Rock Surface,
W79-09981 2K

NUCLEAR ENERGY
Engineering Management of Nuclear Desalination Plants--A Case Study, Saudi Arabia,
W79-09872 3A

NUTRIENT BUDGETS
Inputs and Outputs of Water and Phosphorus from Four Victoria Catchments,
W79-09921 5B

Budgets of Selected Natural Mineral Nutrients for a Southeastern Piedmont Forest and Pasture,
W79-09927 5C

NUTRIENT REMOVAL
Magnesium Uptake from Exchangeable and Nonexchangeable Sources in Soils as Measured by Intensive Cropping,
W79-09908 2I

NUTRIENT REQUIREMENTS
Response of Native Grassland Legumes to Water and Nitrogen Treatments,
W79-10071 2I

NUTRIENTS
Autotrophy in Stream Ecosystems,
W79-09922 5C

Local and Mesoscale Influences on Nutrient Variability in the Northwest African Upwelling Region Near Cabo Corbeiro,
W79-09926 5C

OCEAN DUMPING
Monitoring the Temporal Dispersion of a Sewage Sludge Plume,
W79-10030 5C

OIL FIELDS
Alkanes in Seawater in the Vicinity of the Buccaneer Oilfield,
W79-09905 5B

OIL POLLUTION
Use of Microorganisms in Combination with Surface Active Agents to Synergistically Disperse Oil Slicks,
W79-09930 5G

V-Shaped Oil Containment Boom,
W79-09937 5G

System for Collecting Oil,
W79-09969 5G

Apparatuses to Separate a Mixture of Liquids of Different Specific Gravities, E.G. Oil and Water,
W79-10028 5G

Ecological and Physiological/Toxicological Effects of Petroleum on Aquatic Birds. A Summary of Research Activities FY 76 Through FY 78,
W79-10031 5C

Migration of Birds in Alaska Marine Habitats,
W79-10046 5C

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-10047 5C

Avian Community Ecology of the Akulik-Inglutalik River Delta, Norton Bay, Alaska,
W79-10048 5C

OIL SPILLS
V-Shaped Oil Containment Boom,
W79-09937 5G

System for Collecting Oil,
W79-09969 5G

OILY WATER
Use of Microorganisms in Combination with Surface Active Agents to Synergistically Disperse Oil Slicks,
W79-09930 5G

ON-SITE INVESTIGATIONS
Lagoon Recharge of the Folkestone Beds at Hardham, Sussex--1972-75,
W79-09988 4B

OPTIMIZATION
Regulation Model of the Lake Velence Reservoir System,
W79-09852 6A

Probabilistic Water Quality Control Policies,
W79-09857 6A

On the Monetary Value of an Ecological River Quality Model,
W79-09863 6A

Procedure for the Economical Evaluation of Water Networks' Parameters,
W79-09866 6A

A Multiobjective Model for Regional Water Quality Management,
W79-09867 6A

Modeling Water Distribution in Santa Clara County, Calif.,
W79-09877 4A

Heuristic Decision Rules for Water Resources Planning,
W79-09962 6A

ORGANIC COMPOUNDS
Synthetic Organics,
W79-10050 5C

ORGANIC MATTER
Autotrophy in Stream Ecosystems,
W79-09922 5C

ORGANIZATION
Engineering Management of Nuclear Desalination Plants--A Case Study, Saudi Arabia,
W79-09872 3A

OUTER CONTINENTAL SHELF
Transient Effects of Ocean Wastewater Sludge Dumping,
W79-10029 5C

Monitoring the Temporal Dispersion of a Sewage Sludge Plume,
W79-10030 5C

Ecological and Physiological/Toxicological Effects of Petroleum on Aquatic Birds. A Summary of Research Activities FY 76 Through FY 78,
W79-10031 5C

Distribution and Abundance of Some Epibenthic Invertebrates of the Northeastern Gulf of Alaska with Notes on the Feeding Biology of Selected Species,
W79-10033 5C

Finfish Resource Surveys in Norton Sound and Kotzebue Sound,
W79-10034 5C

Intertidal Biota and Subtidal Kelp Communities of the Kodiak Island Area,
W79-10035 5C

Sorting and Identification of Intertidal Samples,
W79-10036 5C

Baseline Studies of the Demersal Resources of the Eastern and Western Gulf of Alaska Shelf and Slope: A Historical Review,
W79-10037 5C

Beaufort Sea Estuarine Fishery Study,
W79-10038 5C

Preliminary Observations on the Distribution Abundance and Food Habits of Some Nearshore Fishes in the Northeastern Gulf of Alaska,
W79-10039 5C

Levels and Sources of Critical Trace Metals in the Marine Environment,
W79-10040 5B

Acute Toxicity of Heavy Metals,
W79-10041 5C

Pathology of Arctic and Subarctic Marine Species and Exposure to Trace Metals Associated with Petroleum,
W79-10042 5C

Metabolism of Trace Metals: Bioaccumulation and Biotransformation in Marine Organisms,
W79-10043 5C

Behavioral and Physiological Effects Induced by Sublethal Levels of Heavy Metals,
W79-10044 5C

General Effects of Metals on the Ecosystem,
W79-10045 5C

Migration of Birds in Alaska Marine Habitats,
W79-10046 5C

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-10047 5C

Avian Community Ecology of the Akulik-Inglutalik River Delta, Norton Bay, Alaska,
W79-10048 5C

Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, Estes Park, Colorado, July 10-14, 1978,
W79-10049 5A

Fossil Fuel Compounds,
W79-10058 5C

Biological Effects - A Generic View,
W79-10059 5C

OXYGEN DEMAND

An Ecophysiological Study of the Meiofauna of the Swartkops Estuary. 3. Partition of Benthic Oxygen Consumption and the Relative Importance of the Meiofauna,
W79-09924 5C

Reservoir Metalimnion Oxygen Demands: Discussion,
W79-09925 5C

PALEOCLIMATOLOGY

Mid-Eocene Climatic Change, Southwestern California and Northwestern Baja California,
W79-10076 2B

PALEOLIMNOLOGY

Mid-Eocene Climatic Change, Southwestern California and Northwestern Baja California,
W79-10076 2B

PALEOSOLS

Mid-Eocene Climatic Change, Southwestern California and Northwestern Baja California,
W79-10076 2B

PARTICLE SIZE

Grain Coarsening of Water-Saturated Snow,
W79-09975 2C

PASTURES

Budgets of Selected Natural Mineral Nutrients for a Southeastern Piedmont Forest and Pasture,
W79-09927 5C

PATENTS

Wastewater Treatment with Desorbing of an Adsorbate from an Adsorbent with a Solvent in the Near Critical State,
W79-09929 5D

Use of Microorganisms in Combination with Surface Active Agents to Synergistically Disperse Oil Slicks,
W79-09930 5G

Electrochemical Determination of Heavy Metals in Water and Apparatus Therefor,
W79-09935 5A

Flow Monitoring,
W79-09936 8B

V-Shaped Oil Containment Boom,
W79-09937 5G

Apparatus and Method for Controlling Tide Waters,
W79-09938 8A

Process and System for Recovering Water from the Atmosphere,
W79-09940 2A

Process and Apparatus for Separating Matter in Suspension in a Liquid,
W79-09941 5D

Closed Spiral Path Waste Water Treatment System,
W79-09947 5D

Magnetic Water Conditioner,
W79-09955 5F

System for Collecting Oil,
W79-09969 5G

Pump-Type Sludge Dredging Apparatus,
W79-10017 5E

Multiple Emitter Flow Control,
W79-10018 3F

Apparatuses to Separate a Mixture of Liquids of Different Specific Gravities, E.G. Oil and Water,
W79-10028 5G

Water Control and Distribution Apparatus,
W79-10032 5G

Treatment of Mercury Contaminated Aqueous Media,
W79-10069 5D

Process for Scale Control Using Mixtures of Polycationic and Polyanionic Polymers,
W79-10072 3A

Portable Water Filter,
W79-10077 5F

PATHOLOGY

Pathology of Arctic and Subarctic Marine Species and Exposure to Trace Metals Associated with Petroleum,
W79-10042 5C

PEAK DISCHARGE

Flood Plain Information: Mimbres River and Florida Gap Draw, Deming, Luna County, NM,
W79-10013 2E

Flood Hazard Analyses, Worthley Brook, Town of Poland, Maine, Androscoggin County,
W79-10014 2E

PERFORMANCE

Long Term Experiments on Sea Water Desalination at the Chigasaki Laboratory,
W79-09871 3A

Performance Variability of Membrane Filter Procedures,
W79-09883 7B

PERMEABILITY

Salinity Profiles and Leaching Fractions for Slowly Permeable Irrigated Field Soils,
W79-10075 2G

PESTICIDE RESIDUES

Low Picloram Concentrations in Streamflow Resulting from Forest Application of Tordon-10K,
W79-09864 5B

PESTICIDES

Chlorophenols in Surface Waters of the Netherlands (1976-1977),
W79-09987 5A

PHENOLS

Chlorophenols in Surface Waters of the Netherlands (1976-1977),
W79-09987 5A

PHOSPHORUS

Uncertainty Analysis Applied to Vollenweider's Phosphorus Loading Criterion,
W79-09856 5A

Inputs and Outputs of Water and Phosphorus from Four Victoria Catchments,
W79-09921 5B

PHYSIOLOGY

Behavioral and Physiological Effects Induced by Sublethal Levels of Heavy Metals,
W79-10044 5C

PHYTOPLANKTON

Distribution of Phytoplankton in Louisiana Lakes,
W79-10026 2H

Distribution of Phytoplankton in South Dakota Lakes,
W79-10027 2H

PICLORAM

Low Picloram Concentrations in Streamflow Resulting from Forest Application of Tordon-10K,
W79-09864 5B

PIPES

An Analytic Approach to Scheduling Pipe Replacement,
W79-09879 6B

PIT RECHARGE
Lagoon Recharge of the Folkestone Beds at Hardham, Sussex--1972-75,
W79-09988 4B

PLANNING
Environmental Quality and River Basin Development: A Model for Integrated Analysis and Planning,
W79-09850 6A

Management of Water in Wessex,
W79-09861 6A

Heuristic Decision Rules for Water Resources Planning,
W79-09962 6A

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts, EMMA Study, Volume 12: Financing and Management, Parts 1 and 2,
W79-10004 6E

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13: Impact Analysis and Evaluation,
W79-10005 6G

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 14: Public Involvement,
W79-10010 6B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 15: Recommended Plan and Implementation Program,
W79-10011 5D

A Land-Use Planning Model for Coastal Zone Management,
W79-10015 6A

PLANNING CRITERIA
Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 1: Planning Criteria,
W79-09993 5G

POJOAQUE RIVER (NM)
Flood Plain Information: Pojoaque River and Tributaries, Santa Fe County, New Mexico,
W79-10012 2E

POLAND (ME)
Flood Hazard Analyses, Worthley Brook, Town of Poland, Maine, Androscoggin County,
W79-10014 2E

POLLUTANT IDENTIFICATION
Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, Estes Park, Colorado, July 10-14, 1978,
W79-10049 5A

POLLUTION CHARGES
Market Models for Water Pollution Control: Their Strengths and Weaknesses,
W79-10016 6E

POLLUTION RIGHTS
Market Models for Water Pollution Control: Their Strengths and Weaknesses,
W79-10016 6E

POLYPHEMUS PEDICULUS
Distribution Patterns and Population Dynamics of Polyphemus Pediculus (L.) (Crustacea, Cladocera) in a Small New England Lake,
W79-09836 2H

PORES
Performance Variability of Membrane Filter Procedures,
W79-09883 7B

Optimum Membrane Structures for Growth of Fecal Coliform Organisms,
W79-09888 7B

POWERPLANTS
Engineering Management of Nuclear Desalination Plants--A Case Study, Saudi Arabia,
W79-09872 3A

PRECIPITATION (ATMOSPHERIC)
Changes in Cloud Base Precipitation Particle Size-Distributions as a Response Variable to Seeding,
W79-10025 2B

PRICING
What Price, Reject Heat,
W79-09868 6C

PRIMARY PRODUCTIVITY
Autotrophy in Stream Ecosystems,
W79-09922 5C

PROBABILITY
Probabilistic Water Quality Control Policies,
W79-09857 6A

PROGRAMS
Water in a Developing World: The Management of a Critical Resource,
W79-09849 6A

Water Quality Sampling Programs in Rivers,
W79-09859 5A

PROJECT BENEFITS
A Comparison of Evaluations of Four Irrigation Projects,
W79-10019 6B

PROJECT PURPOSES
Central Arizona Project RE:CAP, Information Packet No. 1.
W79-10060 8A

PROJECTIONS
Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 1: Planning Criteria,
W79-09993 5G

PROJECTS
Income Distribution Impacts of a Water Development Project--Boise Project, Idaho, 1950-1970,
W79-09865 6B

PUBLIC HEALTH
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13C: Hygienic Impact Analysis,
W79-10008 5F

Aspects of Environmental Health Impacts of the Aswan High Dam on Rural Population in Egypt,
W79-10066 6G

Nitrate Levels in Groundwater from the Fleuve, Senegal,
W79-10067 5A

Low Cost Methods of Treatment of Agricultural Effluents in Warm Climates,
W79-10068 5D

PUBLIC OPINION
Water Development in Wyoming: A Survey of Resident Attitudes, 1971,
W79-09833 6B

PUBLIC PARTICIPATION
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 14: Public Involvement,
W79-10010 6B

PUMPING
Can Off-Peak Pumping Cut Utility Power Costs,
W79-09860 4A

Experimental Control of Beach Face Dynamics by Watertable Pumping,
W79-09971 2L

PUMPING STATIONS
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Volume 9: MDC Interceptor and Pumping Station Analysis and Improvements.
W79-10001 8B

QUALITY CONTROL
Quality Control of Membrane Filter Media,
W79-09884 7B

RADIOISOTOPES
Exchange of Certain Radionuclides Between the Environment and Fresh-Water Algae,
W79-09923 5C

Artificial Radionuclides,
W79-10054 5C

RAINFALL
A Cloud-Seeding Experiment in Tasmania,
W79-09963 2B

Spatial Correlations of Monthly Rainfall: Applications in Climatology and Weather Modification Experiments,
W79-09964 2B

RAINFALL DISPOSITION
Rainfall in Southern California,
W79-10078 2B

RAINFALL-RUNOFF RELATIONSHIPS
Development of an Extension of ILLUDAS Model for Continuous Simulation of Urban Runoff Quantity and Discrete Simulation of Runoff Quality.
W79-09832 2A

RECREATION
Regulation Model of the Lake Velence Reservoir System,
W79-09852 6A

RECREATION FACILITIES
Central Arizona Project RE:CAP, Information Packet No. 5.
W79-10064 6G

REGENERATION
Wastewater Treatment with Desorbing of an Adsorbate from an Adsorbent with a Solvent in the Near Critical State.
W79-09929 5D

REGIONAL ANALYSIS
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 4: Water Oriented Wastewater Disposal Concepts.
W79-09997 5D

Nitrate Levels in Groundwater from the Fleuve, Senegal,
W79-10067 5A

REGIONAL DEVELOPMENT
Rural Water Development in Arid Regions.
W79-10065 6G

REGIONAL MANAGEMENT
A Multiobjective Model for Regional Water Quality Management,
W79-09867 6A

REGRESSION ANALYSIS
Estimating Sprinkler Distribution Patterns Using Linear Regression,
W79-09915 3F

REGULATION
Regulation Model of the Lake Velence Reservoir System,
W79-09852 6A

Market Models for Water Pollution Control: Their Strengths and Weaknesses,
W79-10016 6E

RELIABILITY
Probabilistic Water Quality Control Policies,
W79-09857 6A

RENNICK GLACIER (ANTARCTIC)
Pattern of Ice Surface Lowering for Rennick Glacier, Northern Victoria Land, Antarctica,
W79-09974 2C

REORGANIZATION
Management of Water in Wessex,
W79-09861 6A

RESERVOIRS
Regulation Model of the Lake Velence Reservoir System,
W79-09852 6A

Reservoir Metalimnion Oxygen Demands: Discussion,
W79-09925 5C

RETURN FLOW
Predicting Irrigation Return Flow Rates,
W79-09913 3F

REVERSE OSMOSIS
Pretreatment of Seawater for Reverse Osmosis Processes: 1976,
W79-09831 3A

Long Term Experiments on Sea Water Desalination at the Chigasaki Laboratory,
W79-09871 3A

The World's First Large Seawater Reverse Osmosis Desalination Plant, at Jeddah, Kingdom of Saudi Arabia,
W79-09873 3A

RHINE RIVER
Chlorophenols in Surface Waters of the Netherlands (1976-1977),
W79-09987 5A

RHINE RIVER (FED REP GERMANY)
On the Monetary Value of an Ecological River Quality Model,
W79-09863 6A

RIO BERMEJO (ARGENTINA)
Environmental Quality and River Basin Development: A Model for Integrated Analysis and Planning,
W79-09850 6A

RIVER BASIN DEVELOPMENT
Environmental Effects of Complex River Development,
W79-09848 4A

Environmental Quality and River Basin Development: A Model for Integrated Analysis and Planning,
W79-09850 6A

RIVER BASINS
Inputs and Outputs of Water and Phosphorus from Four Victoria Catchments,
W79-09921 5B

RIVERS
Water Quality Sampling Programs in Rivers,
W79-09859 5A

A Comparative Case Study of Dynamic Models for DO-BOD-Algae Interaction in a Freshwater River,
W79-09862 5A

ROMANIA
Engineering Problems Associated with Expansive Clays from Romania,
W79-09972 2G

RUNOFF
Nationwide Cost of Wet-Weather Pollution Control,
W79-09858 6B

Methodology of Studies on Chemical Processes in Water Runoff from Rock and Shallow Soil Cover Using Radioactive Tracers,
W79-09980 2K

Interaction Between Simulated Rain and Barren Rock Surface,
W79-09981 2K

SALINE SOILS
Salinity Profiles and Leaching Fractions for Slowly Permeable Irrigated Field Soils,
W79-10075 2G

SALINITY
Drainage Practice in Imperial Valley,
W79-09910 3C

SALT MARSHES
General Effects of Metals on the Ecosystem,
W79-10045 5C

SAMPLING
Water Quality Sampling Programs in Rivers,
W79-09859 5A

SANITARY ENGINEERING
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 2: Engineering Criteria,
W79-09994 8B

SANTA FE COUNTY (NM)
Flood Plain Information: Pojoaque River and Tributaries, Santa Fe County, New Mexico,
W79-10012 2E

SAUDI ARABIA
Engineering Management of Nuclear Desalination Plants--A Case Study, Saudi Arabia,
W79-09872 3A

SCHEDULING
Modeling Water Distribution in Santa Clara County, Calif.,
W79-09877 4A

An Analytic Approach to Scheduling Pipe Replacement,
W79-09879 6B

Scheduling Trims Back Water Use by 7.3 Inches per Acre,
W79-10070 3F

SEA WATER
Long Term Experiments on Sea Water Desalination at the Chigasaki Laboratory,
W79-09871 3A

SEDIMENT DISTRIBUTION
Predicting Irrigation Return Flow Rates,
W79-09913 3F

SEDIMENT YIELD
Water Quality Characteristics of the Horse Creek Watersheds in North Central Idaho,
W79-09838 2A

SEDIMENTATION RATES
Reservoir Metalimnion Oxygen Demands: Discussion,
W79-09925 5C

SEDIMENTOLOGY
Water Quality Characteristics of the Horse Creek Watersheds in North Central Idaho,
W79-09838 2A

SEDIMENTS
A Direct Observation Technique for the Study of Microorganisms in Sediment Samples,
W79-09982 2J

SEEDS
Studies on Natural Water Coagulants in the Sudan, with Special Reference to Moringa Oleifera Seeds,
W79-09844 5F

SEEPAGE
Canal Seepage with Boundary at Finite Depth,
W79-09990 2G

SELECTIVITY
Effect of Injury on the Recovery of Indicator Bacteria on Membrane Filters,
W79-09886 7B

SEPARATION TECHNIQUES
Wastewater Treatment with Desorbing of an Adsorbate from an Adsorbent with a Solvent in the Near Critical State,
W79-09929 5D

Process and Apparatus for Separating Matter in Suspension in a Liquid,
W79-09941 5D

Apparatuses to Separate a Mixture of Liquids of Different Specific Gravities, E.G. Oil and Water,
W79-10028 5G

SETTLING VELOCITY
Reservoir Metalimnion Oxygen Demands: Discussion,
W79-09925 5C

SEWAGE
Comparison of Membrane Filters in Recovery of Naturally Injured Coliforms,
W79-09890 7B

A Simplified Method for the Simulataneous Extraction of Phytoplanktonic Chlorophyll and Fecal Sterol from Water,
W79-09979 5A

SEWAGE BACTERIA
Statistical Interpretation of Membrane Filter Bacteria Counts,
W79-09885 7B

Effect of Injury on the Recovery of Indicator Bacteria on Membrane Filters,
W79-09886 7B

Comparison of Membrane Filter Brands for Recovery of the Coliform Group,
W79-09892 7B

A Layered Membrane Filter Medium for Improved Recovery of Stressed Fecal Coliforms,
W79-09895 7B

SEWAGE DISPOSAL
Monitoring the Temporal Dispersion of a Sewage Sludge Plume,
W79-10030 5C

SEWAGE SLUDGE
Monitoring the Temporal Dispersion of a Sewage Sludge Plume,
W79-10030 5C

SEWERAGE PROJECTIONS
Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 1: Planning Criteria,
W79-09993 5G

SEWERS
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Volume 9: MDC Interceptor and Pumping Station Analysis and Improvements,
W79-10001 8B

SHRINKAGE
Engineering Problems Associated with Expansive Clays from Romania,
W79-09972 2G

SIMULATED RAINFALL
Methodology of Studies on Chemical Processes in Water Runoff from Rock and Shallow Soil Cover Using Radioactive Tracers,
W79-09980 2K

Interaction Between Simulated Rain and Barren Rock Surface,
W79-09981 2K

SIMULATION ANALYSIS
Nationwide Cost of Wet-Weather Pollution Control,
W79-09858 6B

A Comparative Case Study of Dynamic Models for DO-BOD-Algae Interaction in a Freshwater River,
W79-09862 5A

Modeling Water Distribution in Santa Clara County, Calif.,
W79-09877 4A

SIMULATION MODELS
Development of an Extension of ILLUDAS Model for Continuous Simulation of Urban Runoff Quantity and Discrete Simulation of Runoff Quality.
W79-09832 2A

SLOPE STABILITY
Application of Infinite Slope Analysis to Subaqueous Sediment Instability, Mississippi Delta,
W79-09970 2L

SLUDGE DISPOSAL
Transient Effects of Ocean Wastewater Sludge Dumping,
W79-10029 5C

SLUDGE MANAGEMENT
Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study: Summary Report,
W79-09992 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 5: Land Oriented Wastewater Utilization Concepts,
W79-09998 5G

SLUDGE TREATMENT
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 4: Water Oriented Wastewater Disposal Concepts,
W79-09997 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 5: Land Oriented Wastewater Utilization Concepts,
W79-09998 5G

SMALL WATERSHEDS
Some Effects of Urea Fertilization on a Forested Watershed in West Virginia,
W79-09847 2K

SNOW
Grain Coarsening of Water-Saturated Snow,
W79-09975 2C

SOCIAL ASPECTS
Water Development in Wyoming: A Survey of Resident Attitudes, 1971,
W79-09833 6B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13B: Socio-Economic Impact Analysis,
W79-10007 6B

SOCIAL IMPACT
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13B: Socio-Economic Impact Analysis,
W79-10007 6B

SOIL MECHANICS
Engineering Problems Associated with Expansive Clays from Romania,
W79-09972 2G

SOIL PHYSICAL PROPERTIES
Engineering Problems Associated with Expansive Clays from Romania,
W79-09972 2G

Boron Distribution in Soils and Waters of Egypt,
W79-10073 2K

SOIL TEMPERATURE
The Prediction of Mean Monthly Soil Temperature from Mean Monthly Air Temperature,
W79-09906 2A

Soil Water Content and Temperature as Factors in the Volatile Loss of Applied Mercury (II) from Soils,
W79-09916 2K

SOIL WATER
Use of Fluorescent Dyes to Mark the Pathways of Solute Movement through Soils under Leaching Conditions: 1. Laboratory Experiments,
W79-09976 2G

Computer Simulation Model for Predicting Soil Water Content Profiles,
W79-09977 2G

Infiltration as Influenced by Irrigation Water Quality,
W79-09989 5C

SOIL WATER MOVEMENT
Use of Fluorescent Dyes to Mark the Pathways of Solute Movement through Soils under Leaching Conditions: 1. Laboratory Experiments,
W79-09976 2G

Computer Simulation Model for Predicting Soil Water Content Profiles,
W79-09977 2G

Irrigation Water Conservation Using Wide-Spaced Furrows,
W79-10074 3F

Salinity Profiles and Leaching Fractions for Slowly Permeable Irrigated Field Soils,
W79-10075 2G

SOIL-WATER-PLANT RELATIONSHIPS
Response of Native Grassland Legumes to Water and Nitrogen Treatments,
W79-10071 2I

SOLID WASTES
Litter,
W79-10053 5B

SOLUTES
Use of Fluorescent Dyes to Mark the Pathways of Solute Movement through Soils under Leaching Conditions: 1. Laboratory Experiments,
W79-09976 2G

SOUTH DAKOTA
Distribution of Phytoplankton in South Dakota Lakes,
W79-10027 2H

SPATIAL DISTRIBUTION
Spatial Correlations of Monthly Rainfall: Applications in Climatology and Weather Modification Experiments,
W79-09964 2B

SPRINKLER IRRIGATION
Estimating Sprinkler Distribution Patterns Using Linear Regression,
W79-09915 3F

Traveling Boom Sprinkler Operation in Wind,
W79-09967 3F

Sprinkler in the Desert,
W79-10079 3F

STAGE-DISCHARGE RELATIONS
Flood Hazard Analyses, Worthley Brook, Town of Poland, Maine, Androscoggin County,
W79-10014 2E

STANDARDS
Probabilistic Water Quality Control Policies,
W79-09857 6A

STATISTICAL METHODS
Uncertainty Analysis Applied to Vollenweider's Phosphorus Loading Criterion,
W79-09856 5A

Comparative Evaluation of Statistical Methods for Water Supply Forecasting,
W79-09870 2E

STATISTICAL MODELS
Statistical Interpretation of Membrane Filter Bacteria Counts,
W79-09885 7B

STATISTICS
Baseline Studies of the Demersal Resources of the Eastern and Western Gulf of Alaska Shelf and Slope: A Historical Review,
W79-10037 5C

Beaufort Sea Estuarine Fishery Study,
W79-10038 5C

STOCHASTIC PROCESSES
Regulation Model of the Lake Velence Reservoir System,
W79-09852 6A

Water Quality Sampling Programs in Rivers,
W79-09859 5A

STORAGE
Effects of Temperature and Cold Storage on Development Time and Viability of Eggs of the Burrowing Mayfly Hexagenia Rigida (Ephemeroptera: Ephemeridae),
W79-09919 5C

STORM DRAINS
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 7: Combined Sewer Overflow Regulation,
W79-09999 5F

STORM RUNOFF
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Met-

ropolitan Area, EMMA Study, Volume 7: Combined Sewer Overflow Regulation,
W79-09999 5F

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 8: Urban Stormwater Management,
W79-10000 5F

STORM WATER
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 8: Urban Stormwater Management,
W79-10000 5F

STRATIFIED FLOW
A Mathematical Model of Stratified, Bidirectional Flow in Short Culverts,
W79-09835 2A

STRATIGRAPHY
Mid-Eocene Climatic Change, Southwestern California and Northwestern Baja California,
W79-10076 2B

STREAM DISCHARGE
Fluctuations in Naturally Occurring Populations of Enteric Bacteria in Oligotrophic Streams of Western North Carolina,
W79-09902 5A

STREAMS
Inputs and Outputs of Water and Phosphorus from Four Victoria Catchments,
W79-09921 5B

Autotrophy in Stream Ecosystems,
W79-09922 5C

STREETER-PHELPS MODEL
On the Monetary Value of an Ecological River Quality Model,
W79-09863 6A

STREPTOCOCCUS
Effect of Injury on the Recovery of Indicator Bacteria on Membrane Filters,
W79-09886 7B

Recovery Characteristics of Bacteria Injured in the Natural Aquatic Environment,
W79-09894 7B

Evaluation of Methods for Detecting Coliforms and Fecal Streptococci in Chlorinated Secondary Sewage Effluents,
W79-09897 7B

STREPTOCOCCUS BACTERIA
Fluctuations in Naturally Occurring Populations of Enteric Bacteria in Oligotrophic Streams of Western North Carolina,
W79-09902 5A

SUBLETHAL EFFECTS
Behavioral and Physiological Effects Induced by Sublethal Levels of Heavy Metals,
W79-10044 5C

SUBMERGED PLANTS
The Distribution and Seasonality of the Benthic Aquatic Macrophytes of the Pamlico River Estuary, North Carolina,
W79-09834 2L

SUBSIDENCE
Subsidence Related to Land Use in Everglades Agricultural Area,
W79-09968 4A

Central Arizona Project RE:CAP, Information Packet No. 4.
W79-10063 8A

SUBSURFACE FLOW
Simulation of Infiltration from a Continuous and an Intermittent Subsurface Source,
W79-09978 2G

SUFFOLK COUNTY (NY)
A Land-Use Planning Model for Coastal Zone Management,
W79-10015 6A

SURFACE RUNOFF
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 8: Urban Stormwater Management,
W79-10000 5F

SURFACES
Optimum Membrane Structures for Growth of Fecal Coliform Organisms,
W79-09888 7B

SUSPENDED SEDIMENTS
Consequences of Harvesting and Site Preparation in the Piedmont,
W79-09878 5A

SUSPENDED SOLIDS
Monitoring the Temporal Dispersion of a Sewage Sludge Plume,
W79-10030 5C

SWARTKOPS ESTUARY (SOUTH AFRICA)
An Ecophysiological Study of the Meiofauna of the Swartkops Estuary. 3. Partition of Benthic Oxygen Consumption and the Relative Importance of the Meiofauna,
W79-09924 5C

SWITZERLAND
The Formation of Medial Moraines on Alpine Glaciers,
W79-09973 2C

SYSTEMATICS
Sorting and Identification of Intertidal Samples,
W79-10036 5C

SYSTEMS ANALYSIS
Developing a Computer Program for Distribution System Analysis,
W79-09876 4A

TASMANIA
A Cloud-Seeding Experiment in Tasmania,
W79-09963 2B

TECHNOLOGY
The Role of Computers in Transfer of Water Resource Technology,
W79-09853 6A

Computer Applications: A Tool for Water Distribution Engineering,
W79-09875 4A

TECHNOLOGY DEVELOPMENT
Analysis of Investments in Technology Development and Resource Conservation,
W79-09854 6B

TECHNOLOGY TRANSFER
The Role of Computers in Transfer of Water Resource Technology,
W79-09853 6A

TEMPERATURE
Effects of Temperature and Cold Storage on Development Time and Viability of Eggs of the Burrowing Mayfly Hexagenia Rigida (Ephemeroptera: Ephemeridae),
W79-09919 5C

The Development of the Eggs and Early Larvae of Blue Whiting, Micromeisistius Poutassou, and the Effect of Temperature on Development,
W79-09942 5C

Thermal Behavioral Responses of Selected California Littoral Fishes,
W79-09946 5C

Effects of Sudden Temperature Shifts on Pure Cultures of Four Strains of Freshwater Bacteria,
W79-09948 5C

The Effects of Temperature and Different Food Organisms on the Rate of Gastric Evacuation in Perch (Perca Fluviatilis),
W79-09952 5C

The Influence of Some Ecological Factors on the Metabolism-Temperature Curve of the Larvae of Limnephilus Rhombicus, (Trichoptera, Limnephilidae),
W79-09953 5C

Factors Affecting the Burrowing Activity of Macoma Balthica (L.),
W79-09959 5C

Effects of Artificial Rise of Temperature on Stagnant Waters and Their Biocenoses,
W79-09960 5C

TESTING PROCEDURES
The Membrane Filter Dilemma,
W79-09882 7B

Comparison of Membrane Filter Brands for Recovery of the Coliform Group,
W79-09892 7B

Measurement of Fecal Coliforms in Estuarine Water,
W79-09896 7B

The ASTM Proposed Membrane Filter Test Procedure for the Recovery of Fecal Coliforms,
W79-09898 7B

Critique on ASTM Test for Recovery of Fecal Coliforms and Proposal for Modified Method,
W79-09899 7B

TEXAS
A Study of the Reuse of Reused Water,
W79-09846 3C

Nitrogen-Isotope Ratio Studies of Soils and Groundwater Nitrate from Alluvial Fan Aquifers in Texas,
W79-09983 5B

THE NETHERLANDS
Chlorophenols in Surface Waters of the Netherlands (1976-1977),
W79-09987 5A

THERMAL POLLUTION
The Development of the Eggs and Early Larvae of Blue Whiting, Micromeisistius Poutassou, and the Effect of Temperature on Development,
W79-09942 5C

Thermal Behavioral Responses of Selected California Littoral Fishes,
W79-09946 5C

Effect of a Steam Electric Generating Station on the Emergence Timing of the Mayfly, Hexagenia Bilineata,
W79-09949 5C

The Freshwater Littoral Meiofauna in a South Carolina Reservoir Receiving Thermal Effluents,
W79-09950 5C

Growth, Feeding and Mortality of Larval and Early Postlarval Stages of the Oceanic Shrimp Sergestes Similis Hansen,
W79-09951 5C

Effects of Artificial Rise of Temperature on Stagnant Waters and Their Biocenoses,
W79-09960 5C

THERMAL STRESS
Effects of Temperature on the Recovery of Fecal Coliforms,
W79-09887 7B

Laboratory Studies on the Direct Effect of Temperature on the Freshwater Vector Snail, Indoplanorbis Exustus (Deshyes),
W79-09934 5C

Thermal Behavioral Responses of the Speckled Sanddab, Citharichthys Stigmaeus: Laboratory and Field Investigations,
W79-09945 5C

THIN FILMS
Development of Dry Process Microporous Polysulfone Supports for Ultrathin Film Composites,
W79-09839 3A

TIDAL EFFECTS
Experimental Control of Beach Face Dynamics by Watertable Pumping,
W79-09971 2L

TIDAL STREAMS
Apparatus and Method for Controlling Tide Waters,
W79-09938 8A

TIDAL WATERS
Apparatus and Method for Controlling Tide Waters,
W79-09938 8A

TORDON-10K
Low Picloram Concentrations in Streamflow Resulting from Forest Application of Tordon-10K,
W79-09864 5B

TOXICITY
Ecological and Physiological/Toxicological Effects of Petroleum on Aquatic Birds. A Summary of Research Activities FY 76 Through FY 78,
W79-10031 5C

Acute Toxicity of Heavy Metals,
W79-10041 5C

Trace Metals,
W79-10056 5C

TRACE ELEMENTS
Pathology of Arctic and Subarctic Marine Species and Exposure to Trace Metals Associated with Petroleum,
W79-10042 5C

TRACERS
Use of Baker's Yeast to Trace Microbial Movements in Ground Water,
W79-09855 5B

TREATMENT FACILITIES
Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study: Summary Report,
W79-09992 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 4: Water Oriented Wastewater Disposal Concepts,
W79-09997 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Volume 9: MDC Interceptor and Pumping Station Analysis and Improvements.
W79-10001 8B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 10: Deer Island Wastewater Treatment Plant Analysis and Improvements.
W79-10002 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 11: Nut Island Wastewater Treatment Plant Analysis and Improvements.
W79-10003 5D

Construction Costs for Municipal Wastewater Treatment Plants: 1973-1977.
W79-10080 5D

TREATMENT PLANT DESIGN
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 10: Deer Island Wastewater Treatment Plant Analysis and Improvements.
W79-10002 5D

TREMATODES
Aspects of Environmental Health Impacts of the Aswan High Dam on Rural Population in Egypt,
W79-10066 6G

TROPHIC STATES
Uncertainty Analysis Applied to Vollenweider's Phosphorus Loading Criterion,
W79-09856 5A

TURBIDITY
Studies on Natural Water Coagulants in the Sudan, with Special Reference to Moringa Oleifera Seeds,
W79-09844 5F

Fluctuations in Naturally Occurring Populations of Enteric Bacteria in Oligotrophic Streams of Western North Carolina,
W79-09902 5A

UNCERTAINTY ANALYSIS
Uncertainty Analysis Applied to Vollenweider's Phosphorus Loading Criterion,
W79-09856 5A

UNSTEADY FLOW
Simulation of Infiltration from a Continuous and an Intermittent Subsurface Source,
W79-09978 2G

UPWELLING
Local and Mesoscale Influences on Nutrient Variability in the Northwest African Upwelling Region Near Cabo Corbeiro,
W79-09926 5C

URBAN RUNOFF
Development of an Extension of ILLUDAS Model for Continuous Simulation of Urban Runoff Quantity and Discrete Simulation of Runoff Quality.
W79-09832 2A

UREA
Some Effects of Urea Fertilization on a Forested Watershed in West Virginia,
W79-09847 2K

VICTORIA LAND (ANTARCTIC)
Pattern of Ice Surface Lowering for Rennick Glacier, Northern Victoria Land, Antarctica,
W79-09974 2C

VISUAL-CULTURAL IMPACTS
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13D: Visual, Cultural and Design Impact Analysis,
W79-10009 6B

VOLLENWEIDER CRITERION AXES
Uncertainty Analysis Applied to Vollenweider's Phosphorus Loading Criterion,
W79-09856 5A

WASTE DISPOSAL
Infiltration of Liquid Dairy Manure into Soil,
W79-09965 5E

Dredging and Disposal of Its Large-Volume Waste,
W79-10052 5B

WASTE HEAT
What Price, Reject Heat,
W79-09868 6C

WASTE LOADS
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Management Area, EMMA Study, Volume 3B: Study of Wastes from Large Industries,
W79-09995 5B

WASTE WATER DISPOSAL
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 4: Water Oriented Wastewater Disposal Concepts,
W79-09997 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 5: Land Oriented Wastewater Utilization Concepts,
W79-09998 5G

Transient Effects of Ocean Wastewater Sludge Dumping,
W79-10029 5C

WASTE WATER MANAGEMENT
Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study: Summary Report,
W79-09992 5D

Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 1: Planning Criteria,
W79-09993 5G

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Management Area, EMMA Study, Volume 3B: Study of Wastes from Large Industries,
W79-09995 5B

Wastewater Engineering and Management Study for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 3A: Study of Certain Industrial Wastes.
W79-09996 5B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 5: Land Oriented Wastewater Utilization Concepts,
W79-09998 5G

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 7: Combined Sewer Overflow Regulation,
W79-09999 5F

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 8: Urban Stormwater Management.
W79-10000 5F

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Met-

ropolitan Area, Emma Study, Volume 9: MDC Interceptor and Pumping Station Analysis and Improvements.
W79-10001 8B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 10: Deer Island Wastewater Treatment Plant Analysis and Improvements.
W79-10002 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 11: Nut Island Wastewater Treatment Plant Analysis and Improvements.
W79-10003 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts, EMMA Study, Volume 12: Financing and Management, Parts 1 and 2,
W79-10004 6E

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13: Impact Analysis and Evaluation,
W79-10005 6G

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13A: Biological Impact Analysis,
W79-10006 6C

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13B: Socio-Economic Impact Analysis,
W79-10007 6B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13C: Hygienic Impact Analysis,
W79-10008 5F

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13D: Visual, Cultural and Design Impact Analysis,
W79-10009 6B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 14: Public Involvement,
W79-10010 6B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 15: Recommended Plan and Implementation Program,
W79-10011 5D

Wastewater Management Plan. Colorado River and Tributaries, Texas. Summary,
W79-10020 5G

WASTE WATER (POLLUTION)

Concentrations of Nitrilotriacetate and Certain Metals in Canadian Wastewaters and Streams: 1971-1975,
W79-09986 5B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 10: Deer Island Wastewater Treatment Plant Analysis and Improvements.
W79-10002 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 11: Nut Island Wastewater Treatment Plant Analysis and Improvements.
W79-10003 5D

WASTE WATER RECLAMATION

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 5: Land Oriented Wastewater Utilization Concepts,
W79-09998 5G

WASTE WATER TREATMENT

On the Monetary Value of an Ecological River Quality Model,
W79-09863 6A

Wastewater Treatment with Desorbing of an Adsorbate from an Adsorbent with a Solvent in the Near Critical State,
W79-09929 5D

Process and Apparatus for Separating Matter in Suspension in a Liquid,
W79-09941 5D

Closed Spiral Path Waste Water Treatment System,
W79-09947 5D

Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study: Summary Report,
W79-09992 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 2: Engineering Criteria,
W79-09994 8B

Wastewater Engineering and Management Study for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 3A: Study of Certain Industrial Wastes.
W79-09996 5B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 4: Water Oriented Wastewater Disposal Concepts,
W79-09997 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 5: Land Oriented Wastewater Utilization Concepts,
W79-09998 5G

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 7: Combined Sewer Overflow Regulation,
W79-09999 5F

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 8: Urban Stormwater Management,
W79-10000 5F

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Volume 9: MDC Interceptor and Pumping Station Analysis and Improvements.
W79-10001 8B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 10: Deer Island Wastewater Treatment Plant Analysis and Improvements.
W79-10002 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 11: Nut Island Wastewater Treatment Plant Analysis and Improvements.
W79-10003 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts, EMMA Study, Volume 12: Financing and Management, Parts 1 and 2,
W79-10004 6E

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13B: Socio-Economic Impact Analysis,
W79-10007 6B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13C: Hygienic Impact Analysis,
W79-10008 5F

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13D: Visual, Cultural and Design Impact Analysis,
W79-10009 6B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 14: Public Involvement,
W79-10010 6B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 15: Recommended Plan and Implementation Program,
W79-10011 5D

Low Cost Methods of Treatment of Agricultural Effluents in Warm Climates,
W79-10068 5D

Treatment of Mercury Contaminated Aqueous Media,
W79-10069 5D

Construction Costs for Municipal Wastewater Treatment Plants: 1973-1977.
W79-10080 5D

WASTEWATER TREATMENT

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13A: Biological Impact Analysis,
W79-10006 6C

WATER ALLOCATION (POLICY)

Central Arizona Project RE:CAP, Information Packet No. 1.
W79-10060 8A

Central Arizona Project RE:CAP, Information Packet No. 3.
W79-10062 5G

WATER ANALYSIS

Water Analysis in South Africa: Interlaboratory Comparison Studies, Part IV: Mineral Analysis,
W79-09841 9C

Water Quality Sampling Programs in Rivers,
W79-09859 5A

WATER BALANCE

Inputs and Outputs of Water and Phosphorus from Four Victoria Catchments,
W79-09921 5B

WATER CHEMISTRY
The Chemical Composition of the Upper Hennops River and its Implications on the Water Quality of Rietvlei Dam,
W79-09843 5A

Methodology of Studies on Chemical Processes in Water Runoff from Rock and Shallow Soil Cover Using Radioactive Tracers,
W79-09980 2K

Interaction Between Simulated Rain and Barren Rock Surface,
W79-09981 2K

Boron Distribution in Soils and Waters of Egypt,
W79-10073 2K

WATER COSTS
Central Arizona Project RE:CAP, Information Packet No. 2.
W79-10061 6C

WATER DELIVERY
Modeling Water Distribution in Santa Clara County, Calif.,
W79-09877 4A

WATER DISTRIBUTION (APPLIED)
Can Off-Peak Pumping Cut Utility Power Costs,
W79-09860 4A

Computer Applications: A Tool for Water Distribution Engineering,
W79-09875 4A

Developing a Computer Program for Distribution System Analysis,
W79-09876 4A

Modeling Water Distribution in Santa Clara County, Calif.,
W79-09877 4A

WATER LAW
Water in a Developing World: The Management of a Critical Resource,
W79-09849 6A

WATER LEVELS
Regulation Model of the Lake Velence Reservoir System,
W79-09852 6A

WATER MANAGEMENT (ADMINISTRATIVE)
Wastewater Management Plan. Colorado River and Tributaries, Texas. Summary,
W79-10020 5G

WATER MANAGEMENT (APPLIED)
Management of Water in Wessex,
W79-09861 6A

WATER POLICY
Probabilistic Water Quality Control Policies,
W79-09857 6A

WATER POLLUTION
Effect of Selenium Dioxide on the Accumulation and Acute Toxicity of Mercuric Chloride in Goldfish,
W79-09901 5C

The Effect of Temperature on Copper Tolerance of Paramecium,
W79-09903 5C

Alkanes in Seawater in the Vicinity of the Buccaneer Oilfield,
W79-09905 5B

A Morphological Defect in Shiner Perch Resulting from Chronic Exposure to Chlorinated Sea Water,
W79-09907 5C

Pathways for Mercury Uptake by Fish from Bed Sediments,
W79-09918 5B

Reduction of Blood Plasma Copper Concentrations in a Marine Fish Following a Six Month Exposure to Crude Oil,
W79-09931 5C

Influences of Hardness Constituents on the Acute Toxicity of Cadmium to Brook Trout (Salvelinus Fontinalis),
W79-09932 5C

Trace Metal Uptake by Three Species of Mollusks,
W79-09933 5C

Electrochemical Determination of Heavy Metals in Water and Apparatus Therefor,
W79-09935 5A

Mercury Contamination of Fish in Guatemala,
W79-09939 5C

Effects of Water-Soluble Chlorine-Containing Organics on Aquatic Environments--Another Perspective,
W79-09954 5C

Toxicity of Gallium and Beryllium to Developing Carp Eggs (Cyprinus Carpio) Utilizing Copper as a Reference,
W79-09958 5C

The Quality of Run-Off from an Irrigated Market Garden Area in Brazil,
W79-09985 5B

Concentrations of Nitrilotriacetate and Certain Metals in Canadian Wastewaters and Streams: 1971-1975,
W79-09986 5B

Chlorophenols in Surface Waters of the Netherlands (1976-1977),
W79-09987 5A

Market Models for Water Pollution Control: Their Strengths and Weaknesses,
W79-10016 6E

Monitoring the Temporal Dispersion of a Sewage Sludge Plume,
W79-10030 5C

Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, Estes Park, Colorado, July 10-14, 1978,
W79-10049 5A

WATER POLLUTION CONTROL
Nationwide Cost of Wet-Weather Pollution Control,
W79-09858 6B

On the Monetary Value of an Ecological River Quality Model,
W79-09863 6A

Market Models for Water Pollution Control: Their Strengths and Weaknesses,
W79-10016 6E

Apparatuses to Separate a Mixture of Liquids of Different Specific Gravities, E.G. Oil and Water,
W79-10028 5G

WATER POLLUTION EFFECTS
Transient Effects of Ocean Wastewater Sludge Dumping,
W79-10029 5C

Ecological and Physiological/Toxicological Effects of Petroleum on Aquatic Birds. A Summary of Research Activities FY 76 Through FY 78,
W79-10031 5C

Distribution and Abundance of Some Epibenthic Invertebrates of the Northeastern Gulf of Alaska with Notes on the Feeding Biology of Selected Species,
W79-10033 5C

Finfish Resource Surveys in Norton Sound and Kotzebue Sound,
W79-10034 5C

Intertidal Biota and Subtidal Kelp Communities of the Kodiak Island Area,
W79-10035 5C

Metabolism of Trace Metals: Bioaccumulation and Biotransformation in Marine Organisms,
W79-10043 5C

Behavioral and Physiological Effects Induced by Sublethal Levels of Heavy Metals,
W79-10044 5C

General Effects of Metals on the Ecosystem,
W79-10045 5C

Migration of Birds in Alaska Marine Habitats,
W79-10046 5C

Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-10047 5C

Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, Estes Park, Colorado, July 10-14, 1978,
W79-10049 5A

Synthetic Organics,
W79-10050 5C

Chlorination Products,
W79-10051 5C

Litter,
W79-10053 5B

Artificial Radionuclides,
W79-10054 5C

Trace Metals,
W79-10056 5C

Fossil Fuel Compounds,
W79-10058 5C

Biological Effects - A Generic View,
W79-10059 5C

WATER POLLUTION SOURCES
A Layered Membrane Filter Medium for Improved Recovery of Stressed Fecal Coliforms,
W79-09895 7B

Pathways for Mercury Uptake by Fish from Bed Sediments,
W79-09918 5B

The Quality of Run-Off from an Irrigated Market Garden Area in Brazil,
W79-09985 5B

Wastewater Engineering and Management Study for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study. Technical Data Volume 3A: Study of Certain Industrial Wastes.
W79-09996 5B

A Land-Use Planning Model for Coastal Zone Management.
W79-10015 6A

Levels and Sources of Critical Trace Metals in the Marine Environment.
W79-10040 5B

WATER POLLUTION SOURCES

Proceedings of a Workshop on Scientific Problems Relating to Ocean Pollution, Estes Park, Colorado, July 10-14, 1978,
W79-10049 5A

Dredging and Disposal of Its Large-Volume Waste,
W79-10052 5B

Litter,
W79-10053 5B

Artificial Radionuclides,
W79-10054 5C

Microorganisms,
W79-10055 5C

WATER POLLUTION TREATMENT

Wastewater Treatment with Desorbing of an Adsorbate from an Adsorbent with a Solvent in the Near Critical State,
W79-09929 5D

Process and Apparatus for Separating Matter in Suspension in a Liquid,
W79-09941 5D

Low Cost Methods of Treatment of Agricultural Effluents in Warm Climates,
W79-10068 5D

Treatment of Mercury Contaminated Aqueous Media,
W79-10069 5D

WATER PURIFICATION

Studies on Natural Water Coagulants in the Sudan, with Special Reference to Moringa Oleifera Seeds,
W79-09844 5F

Disinfection of Water: Pros and Cons,
W79-09845 5D

Water Control and Distribution Apparatus,
W79-10032 5G

Portable Water Filter,
W79-10077 5F

WATER QUALITY

The Chemical Composition of the Upper Hennops River and its Implications on the Water Quality of Rietvlei Dam,
W79-09843 5A

Uncertainty Analysis Applied to Vollenweider's Phosphorus Loading Criterion,
W79-09856 5A

Water Quality Sampling Programs in Rivers,
W79-09859 5A

A Comparative Case Study of Dynamic Models for DO-BOD-Algae Interaction in a Freshwater River,
W79-09862 5A

Low Picloram Concentrations in Streamflow Resulting from Forest Application of Tordon-10K,
W79-09864 5B

Elements of a Water Quality Information System for the State of Illinois,
W79-09869 5A

Consequences of Harvesting and Site Preparation in the Piedmont,
W79-09878 5A

State of the Art in Managing Water Resources on Forest Land,
W79-09880 3B

Effects of Calcium Addition as Ca(NO3)2 on Zinc Toxicity to Fathead Minnows, Pimephales Promelas, Rafinesque,
W79-09928 5C

A Simplified Method for the Simulataneous Extraction of Phytoplanktonic Chlorophyll and Fecal Sterol from Water,
W79-09979 5A

The Quality of Run-Off from an Irrigated Market Garden Area in Brazil,
W79-09985 5B

Infiltration as Influenced by Irrigation Water Quality,
W79-09989 5C

Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study: Summary Report,
W79-09992 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Management Area, EMMA Study, Volume 3B: Study of Wastes from Large Industries,
W79-09995 5B

Wastewater Engineering and Management Study for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 3A: Study of Certain Industrial Wastes.
W79-09996 5B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13A: Biological Impact Analysis,
W79-10006 6C

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13C: Hygienic Impact Analysis,
W79-10008 5F

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 15: Recommended Plan and Implementation Program,
W79-10011 5D

Market Models for Water Pollution Control: Their Strengths and Weaknesses,
W79-10016 6E

Wastewater Management Plan. Colorado River and Tributaries, Texas. Summary,
W79-10020 5G

Central Arizona Project RE:CAP, Information Packet No. 3.
W79-10062 5G

Nitrate Levels in Groundwater from the Fleuve, Senegal,
W79-10067 5A

WATER QUALITY CONTROL

Use of Baker's Yeast to Trace Microbial Movements in Ground Water,
W79-09855 5B

Probabilistic Water Quality Control Policies,
W79-09857 6A

A Multiobjective Model for Regional Water Quality Management,
W79-09867 6A

Magnetic Water Conditioner,
W79-09955 5F

System for Collecting Oil,
W79-09969 5G

Process for Scale Control Using Mixtures of Polycationic and Polyanionic Polymers,
W79-10072 3A

Portable Water Filter,
W79-10077 5F

WATER RESOURCES

Environmental Effects of Complex River Development,
W79-09848 4A

Water in a Developing World: The Management of a Critical Resource,
W79-09849 6A

The Role of Computers in Transfer of Water Resource Technology,
W79-09853 6A

Analysis of Investments in Technology Development and Resource Conservation,
W79-09854 6B

Wastewater Management Plan. Colorado River and Tributaries, Texas. Summary,
W79-10020 5G

WATER RESOURCES DEVELOPMENT

Income Distribution Impacts of a Water Development Project--Boise Project, Idaho, 1950-1970,
W79-09865 6B

A Comparison of Evaluations of Four Irrigation Projects,
W79-10019 6B

Central Arizona Project RE:CAP, Information Packet No. 1.
W79-10060 8A

Rural Water Development in Arid Regions,
W79-10065 6G

WATER RESOURCES PLANNING

Central Arizona Project RE:CAP, Information Packet No. 4.
W79-10063 8A

WATER REUSE

A Study of the Reuse of Reused Water,
W79-09846 3C

Water Factory 21 Design and Operating Data,
W79-09961 5D

WATER SPREADING

Time of Spread Relationship in Irrigation Check Basins,
W79-09917 2G

WATER STORAGE

Central Arizona Project RE:CAP, Information Packet No. 4.
W79-10063 8A

WATER SUPPLY

Environmental Effects of Complex River Development,
W79-09848 4A

Comparative Evaluation of Statistical Methods for Water Supply Forecasting,
W79-09870 2E

State of the Art in Managing Water Resources on Forest Land,
W79-09880 3B

Central Arizona Project RE:CAP, Information Packet No. 1.
W79-10060 8A

Rural Water Development in Arid Regions,
W79-10065 6G

WATER SUPPLY DEVELOPMENT

Rural Water Development in Arid Regions,
W79-10065 6G

WATER SYSTEMS

Procedure for the Economical Evaluation of Water Networks' Parameters,
W79-09866 6A

WATER TABLE
Water Requirements and Water Table Variations for a Controlled and Reversible Drainage System,
W79-09966 2G

Experimental Control of Beach Face Dynamics by Watertable Pumping,
W79-09971 2L

An Analytical Solution for the Transient Ditch Drainage Problem,
W79-09984 2G

WATER TEMPERATURE
Reservoir Metalimnion Oxygen Demands: Discussion,
W79-09925 5C

WATER TREATMENT
Magnetic Water Conditioner,
W79-09955 5F

Water Control and Distribution Apparatus,
W79-10032 5G

Process for Scale Control Using Mixtures of Polycationic and Polyanionic Polymers,
W79-10072 3A

Portable Water Filter,
W79-10077 5F

WATER VALUES
The Economic Value of Irrigation Water in the Western United States,
W79-10023 6B

WATER WELLS
A Study of the Reuse of Reused Water,
W79-09846 3C

WATERSHED MANAGEMENT
Low Picloram Concentrations in Streamflow Resulting from Forest Application of Tordon-10K,
W79-09864 5B

WATERSHEDS (BASINS)
Water Quality Characteristics of the Horse Creek Watersheds in North Central Idaho,
W79-09838 2A

Inputs and Outputs of Water and Phosphorus from Four Victoria Catchments,
W79-09921 5B

Budgets of Selected Natural Mineral Nutrients for a Southeastern Piedmont Forest and Pasture,
W79-09927 5C

WEATHER MODIFICATION
A Cloud-Seeding Experiment in Tasmania,
W79-09963 2B

Changes in Cloud Base Precipitation Particle Size-Distributions as a Response Variable to Seeding,
W79-10025 2B

WESSEX (GREAT BRITAIN)
Management of Water in Wessex,
W79-09861 6A

WET-WEATHER POLLUTION
Nationwide Cost of Wet-Weather Pollution Control,
W79-09858 6B

WILDLIFE CONSERVATION
Central Arizona Project RECAP, Information Packet No. 5.
W79-10064 6G

WINDS
Local and Mesoscale Influences on Nutrient Variability in the Northwest African Upwelling Region Near Cabo Corbeiro,
W79-09926 5C

Traveling Boom Sprinkler Operation in Wind,
W79-09967 3F

WORTHLEY BROOK (ME)
Flood Hazard Analyses, Worthley Brook, Town of Poland, Maine, Androscoggin County,
W79-10014 2E

WYOMING
Water Development in Wyoming: A Survey of Resident Attitudes, 1971,
W79-09833 6B

YEASTS
Use of Baker's Yeast to Trace Microbial Movements in Ground Water,
W79-09855 5B

Comparison of Membrane Filter Counts and Plate Counts on Heterotrophic and Oil Agar Used to Estimate Populations of Yeast, Fungi and Bacteria,
W79-09900 7B

AUTHOR INDEX

ABBOTT, P. L.
Mid-Eocene Climatic Change, Southwestern California and Northwestern Baja California,
W79-10076 2B

ABDUL-FATTAH, A. F.
Engineering Management of Nuclear Desalination Plants--A Case Study, Saudi Arabia,
W79-09872 3A

ABRAHAMSEN, G.
Interaction Between Simulated Rain and Barren Rock Surface,
W79-09981 2K

ADAMS, K. E.
Anthropological Investigations Near the Crest of the Continent, 1975-1978,
W79-09840 6G

ADAMSON, P. T.
Probability Distributions of Best Fit to South African Flood Data,
W79-09842 2E

ADULBHAN, P.
A Multiobjective Model for Regional Water Quality Management,
W79-09867 6A

AHLERT, R. C.
Dispersion in the Upper Delaware Estuary,
W79-10021 2L

AKILESWARAN, V.
Heuristic Decision Rules for Water Resources Planning,
W79-09962 6A

AL-GHOLAIKAH, A.
The World's First Large Seawater Reverse Osmosis Desalination Plant, at Jeddah, Kingdom of Saudi Arabia,
W79-09873 3A

ARGO, D. G.
Water Factory 21 Design and Operating Data,
W79-09961 5D

ATTIG, J. W. JR.
Pattern of Ice Surface Lowering for Rennick Glacier, Northern Victoria Land, Antarctica,
W79-09974 2C

BAILEY, C. A.
Efficiency of Coliform Recovery Using Two Brands of Membrane Filters,
W79-09891 7B

BALIGAR, V. C.
Cation Exchange Equilibria in Florida and Indiana Histosols,
W79-09912 2K

BARBER, S. A.
Cation Exchange Equilibria in Florida and Indiana Histosols,
W79-09912 2K

BARNARD, W. D.
Dredging and Disposal of Its Large-Volume Waste,
W79-10052 5B

BARNTHOUSE, L. W.
An Empirical Model of Impingement Impact,
W79-09944 5C

BARTON, L. H.
Finfish Resource Surveys in Norton Sound and Kotzebue Sound,
W79-10034 5C

BASAK, P.
An Analytical Solution for the Transient Ditch Drainage Problem,
W79-09984 2G

BASILE, B.
Alkanes in Seawater in the Vicinity of the Buccaneer Oilfield,
W79-09905 5B

BEALE, H. B. R.
A Comparison of Evaluations of Four Irrigation Projects,
W79-10019 6B

BEAN, R. M.
Chlorination Products,
W79-10051 5C

BEATTIE, B. R.
The Economic Value of Irrigation Water in the Western United States,
W79-10023 6B

BECK, M. B.
A Comparative Case Study of Dynamic Models for DO-BOD-Algae Interaction in a Freshwater River,
W79-09862 5A

BELTRAMI, E.
A Land-Use Planning Model for Coastal Zone Management,
W79-10015 6A

BENDOCK, T. N.
Beaufort Sea Estuarine Fishery Study,
W79-10038 5C

BENNETT, J.
V-Shaped Oil Containment Boom,
W79-09937 5G

BERTINE, C. K.
Trace Metals,
W79-10056 5C

BERWICK, M.
Nitrate Levels in Groundwater from the Fleuve, Senegal,
W79-10067 5A

BIESLADKA, E.
Effects of Artificial Rise of Temperature on Stagnant Waters and Their Biocenoses,
W79-09960 5C

BISSONNETTE, G. K.
Recovery Characteristics of Bacteria Injured in the Natural Aquatic Environment,
W79-09894 7B

BJOR, K.
Interaction Between Simulated Rain and Barren Rock Surface,
W79-09981 2K

BLOGOSLAWSKI, W. J.
Chlorination Products,
W79-10051 5C

BOKUNIEWICZ, H.
Dredging and Disposal of Its Large-Volume Waste,
W79-10052 5B

BONDURANT, J. A.
Predicting Irrigation Return Flow Rates,
W79-09913 3F

BORDNER, R. H.
The Membrane Filter Dilemma,
W79-09882 7B

BOYDSTUN, E. S.
Income Distribution Impacts of a Water Development Project--Boise Project, Idaho, 1950-1970,
W79-09865 6B

BRADLEY, R. M.
The Quality of Run-Off from an Irrigated Market Garden Area in Brazil,
W79-09985 5B

BRADSHAW, M. P.
Experimental Control of Beach Face Dynamics by Watertable Pumping,
W79-09971 2L

BRINKHOFF, H. C.
Analysis of Nitrate Content of Surface Water and Effluent Water. Applications of a Plastic-Membrane Nitrate-Selective Electrode in Water Quality Monitors,
W79-09920 5C

BROCKWAY, C. E.
Predicting Irrigation Return Flow Rates,
W79-09913 3F

BRODSKY, M. H.
A Comparison of Membrane Filters and Media Used to Recover Coliforms from Water,
W79-09889 7B

BROWN, D.
Trace Metals,
W79-10056 5C

BROWN, M. J.
Magnetic Water Conditioner,
W79-09955 5F

Predicting Irrigation Return Flow Rates,
W79-09913 3F

BROWNRIDGE, F. A.
Concentrations of Nitrilotriacetate and Certain Metals in Canadian Wastewaters and Streams: 1971-1975,
W79-09986 5B

BUCKLES, N. B.
Anthropological Investigations Near the Crest of the Continent, 1975-1978,
W79-09840 6G

BUCKLES, W. G.
Anthropological Investigations Near the Crest of the Continent, 1975-1978,
W79-09840 6G

BURCH, M. B.
Effects of Water-Soluble Chlorine-Containing Organics on Aquatic Environments--Another Perspective,
W79-09954 5C

BUSSCHER, W. J.
Simulation of Infiltration from a Continuous and an Intermittent Subsurface Source,
W79-09978 2G

BUTLER, J. N.
Fossil Fuel Compounds,
W79-10058 5C

BUTLER, P. A.
Synthetic Organics,
W79-10050 5C

CABELLI, V. J.
Comparison of Membrane Filter Brands for Recovery of the Coliform Group,
W79-09892 7B

Microorganisms,
W79-10055 5C

CABRAL, D. JR.
The Quality of Run-Off from an Irrigated Market Garden Area in Brazil,
W79-09985 5B

CAIRNS, C. A.
Reservoir Metalimnion Oxygen Demands: Discussion,
W79-09925 5C

CALDWELL, A. C.
Fertilizer Nitrogen Distribution Under Irrigation Between Soil, Plant, and Aquifer,
W79-10024 4B

CALVIN, N. I.
Intertidal Biota and Subtidal Kelp Communities of the Kodiak Island Area,
W79-10035 5C

CAMERON, D. R.
Computer Simulation Model for Predicting Soil Water Content Profiles,
W79-09977 2G

Nitrogen and Chloride Leaching in a Sandy Field Plot,
W79-09911 2G

CAMPBELL, I. C.
Inputs and Outputs of Water and Phosphorus from Four Victoria Catchments,
W79-09921 5B

CARLUCCI, A. F.
Microorganisms,
W79-10055 5C

CARPENTER, E. J.
Litter,
W79-10053 5B

CARPENTER, J. H.
Chlorination Products,
W79-10051 5C

CARROLL, J. J.
Influences of Hardness Constituents on the Acute Toxicity of Cadmium to Brook Trout (Salvelinus Fontinalis),
W79-09932 5C

CARROLL, T. O.
A Land-Use Planning Model for Coastal Zone Management,
W79-10015 6A

CAVES, J. L.
Computer Applications: A Tool for Water Distribution Engineering,
W79-09875 4A

CAWSE, T. J. P.
The Formation of Medial Moraines on Alpine Glaciers,
W79-09973 2C

CHANG, E. S.
Alkanes in Seawater in the Vicinity of the Buccaneer Oilfield,
W79-09905 5B

CHAO, J-L.
Can Off-Peak Pumping Cut Utility Power Costs,
W79-09860 4A

CHAPPELL, J.
Experimental Control of Beach Face Dynamics by Watertable Pumping,
W79-09971 2L

CHAWLA, A. S.
Canal Seepage with Boundary at Finite Depth,
W79-09990 2G

CHEN, N. C. J.
Spatial Correlations of Monthly Rainfall: Applications in Climatology and Weather Modification Experiments,
W79-09964 2B

CHRISTENSEN, S. W.
An Empirical Model of Impingement Impact,
W79-09944 5C

CHRISTENSON, D. R.
Magnesium Uptake from Exchangeable and Nonexchangeable Sources in Soils as Measured by Intensive Cropping,
W79-09908 2I

CHRISTOPHERSEN, N.
Methodology of Studies on Chemical Processes in Water Runoff from Rock and Shallow Soil Cover Using Radioactive Tracers,
W79-09980 2K

CHRISTY, M. H.
Multiple Emitter Flow Control,
W79-10018 3F

CLARK, M. J.
The Formation of Medial Moraines on Alpine Glaciers,
W79-09973 2C

CLARK, R. C. JR.
Levels and Sources of Critical Trace Metals in the Marine Environment,
W79-10040 5B

CODISPOTI, L. A.
Local and Mesoscale Influences on Nutrient Variability in the Northwest African Upwelling Region Near Cabo Corbeiro,
W79-09926 5C

COLWELL, R. R.
Comparison of Membrane Filter Counts and Plate Counts on Heterotrophic and Oil Agar Used to Estimate Populations of Yeast, Fungi and Bacteria,
W79-09900 7B

CONRAD, B. F.
Comparison of Membrane Filter Counts and Plate Counts on Heterotrophic and Oil Agar Used to Estimate Populations of Yeast, Fungi and Bacteria,
W79-09900 7B

COOMBS, S. H.
The Development of the Eggs and Early Larvae of Blue Whiting, Micromeisistius Poutassou, and the Effect of Temperature on Development,
W79-09942 5C

COTTON, R. A.
Statistical Interpretation of Membrane Filter Bacteria Counts,
W79-09885 7B

CRADDOCK, D. A.
Acute Toxicity of Heavy Metals,
W79-10041 5C

CRAIG, R. B.
An Investigation of Plutonium Concentration and Distribution in a Burrowing Crayfish from the White Oak Creek Floodplain,
W79-09943 5C

CRECELIUS, E.
Trace Metals,
W79-10056 5C

CRETNEY, W. J.
Litter,
W79-10053 5B

CULLEN, D. R.
A Study of the Permanent Effects of Elevated Temperature on the Hydraulic Properties of Clay,
W79-10022 8B

CURL, H. JR.
Biostimulants,
W79-10057 5C

CUSHMAN, R. M.
Toxicity of Gallium and Beryllium to Developing Carp Eggs (Cyprinus Carpio) Utilizing Copper as a Reference,
W79-09958 5C

CUTSHALL, N.
Artificial Radionuclides,
W79-10054 5C

DAHL, J. B.
Methodology of Studies on Chemical Processes in Water Runoff from Rock and Shallow Soil Cover Using Radioactive Tracers,
W79-09980 2K

DAHLMAN, R. C.
An Investigation of Plutonium Concentration and Distribution in a Burrowing Crayfish from the White Oak Creek Floodplain,
W79-09943 5C

DANDY, G. C.
Water Quality Sampling Programs in Rivers,
W79-09859 5A

DAVIES, P. H.
Effects of Calcium Addition as Ca(NO3)2 on Zinc Toxicity to Fathead Minnows, Pimephales Promelas, Rafinesque,
W79-09928 5C

DAVIS, A. L.
Developing a Computer Program for Distribution System Analysis,
W79-09876 4A

DAVIS, D. W.
The ASTM Proposed Membrane Filter Test Procedure for the Recovery of Fecal Coliforms,
W79-09898 7B

DAVIS, H. H.
User's Manual for Agricultural Runoff Management (ARM) Model,
W79-09904 5G

DAVIS, J. G.
Minimizing the Salt Burden of Irrigation Drainage Water in the Pecos Valley of New Mexico.
W79-09837 3B

DAVIS, W.
Chlorination Products,
W79-10051 5C

DAWSON, F. W.
Optimum Membrane Structures for Growth of Fecal Coliform Organisms,
W79-09888 7B

DE CAMPOS, M.
Mercury Contamination of Fish in Guatemala,
W79-09939 5C

DE JONG, R.
Computer Simulation Model for Predicting Soil Water Content Profiles,
W79-09977 2G

DEANGELIS, D. L.
An Empirical Model of Impingement Impact,
W79-09944 5C

DEINES, S.
Water Control and Distribution Apparatus,
W79-10032 5G

DELANEY, J. E.
Measurement of Fecal Coliforms in Estuarine Water,
W79-09896 7B

DELANEY, M. S.
An Investigation of Plutonium Concentration and Distribution in a Burrowing Crayfish from the White Oak Creek Floodplain,
W79-09943 5C

DELLEUR, J. W.
Development of an Extension of ILLUDAS Model for Continuous Simulation of Urban Runoff Quantity and Discrete Simulation of Runoff Quality.
W79-09832 2A

DETAR, W. R.
Infiltration of Liquid Dairy Manure into Soil,
W79-09965 5E

DICK, R. I.
Reservoir Metalimnion Oxygen Demands: Discussion,
W79-09925 5C

DIETER, M. P.
Ecological and Physiological/Toxicological Effects of Petroleum on Aquatic Birds. A Summary of Research Activities FY 76 Through FY 78,
W79-10031 5C

DIRAR, H.
Studies on Natural Water Coagulants in the Sudan, with Special Reference to Moringa Oleifera Seeds,
W79-09844 5F

DODD, J. L.
Response of Native Grassland Legumes to Water and Nitrogen Treatments,
W79-10071 2I

DOLL, E. C.
Magnesium Uptake from Exchangeable and Nonexchangeable Sources in Soils as Measured by Intensive Cropping,
W79-09908 2I

DONIGIAN, A. S.
User's Manual for Agricultural Runoff Management (ARM) Model,
W79-09904 5G

DONOVAN, T. J.
Salinity Profiles and Leaching Fractions for Slowly Permeable Irrigated Field Soils,
W79-10075 2G

DORMAN, C. E.
Rainfall in Southern California,
W79-10078 2B

DOTY, C. W.
Water Requirements and Water Table Variations for a Controlled and Reversible Drainage System,
W79-09966 2G

DOUGLASS, J. E.
Consequences of Harvesting and Site Preparation in the Piedmont,
W79-09878 5A

Low Picloram Concentrations in Streamflow Resulting from Forest Application of Tordon-10K,
W79-09864 5B

State of the Art in Managing Water Resources on Forest Land,
W79-09880 3B

DRAXLER, A. F. J.
Transient Effects of Ocean Wastewater Sludge Dumping,
W79-10029 5C

DREWRY, D. J.
Pattern of Ice Surface Lowering for Rennick Glacier, Northern Victoria Land, Antarctica,
W79-09974 2C

DUEDALL, I. W.
Monitoring the Temporal Dispersion of a Sewage Sludge Plume,
W79-10030 5C

DUFOUR, A. P.
Comparison of Membrane Filter Brands for Recovery of the Coliform Group,
W79-09892 7B

DUGDALE, R.
Biostimulants,
W79-10057 5C

DYE, A. H.
An Ecophysiological Study of the Meiofauna of the Swartkops Estuary. 3. Partition of Benthic Oxygen Consumption and the Relative Importance of the Meiofauna,
W79-09924 5C

DYE, L. L.
Effect of a Steam Electric Generating Station on the Emergence Timing of the Mayfly, Hexagenia Bileneata,
W79-09949 5C

DYLLA, A. S.
Traveling Boom Sprinkler Operation in Wind,
W79-09967 3F

EARL, T. C.
Computer Applications: A Tool for Water Distribution Engineering,
W79-09875 4A

EHLIG, C. F.
Salinity Profiles and Leaching Fractions for Slowly Permeable Irrigated Field Soils,
W79-10075 2G

EHRLICH, G. G.
Use of Baker's Yeast to Trace Microbial Movements in Ground Water,
W79-09855 5B

EHRLICH, K. F.
Thermal Behavioral Responses of Selected California Littoral Fishes,
W79-09946 5C

Thermal Behavioral Responses of the Speckled Sanddab, Citharichthys Stigmaeus: Laboratory and Field Investigations,
W79-09945 5C

EL-RAMLY, N.
The World's First Large Seawater Reverse Osmosis Desalination Plant, at Jeddah, Kingdom of Saudi Arabia,
W79-09873 3A

ELDON, J.
Factors Affecting the Burrowing Activity of Macoma Balthica (L.),
W79-09959 5C

ELIOT, I. G.
Experimental Control of Beach Face Dynamics by Watertable Pumping,
W79-09971 2L

ELLIS, S. J.
Influences of Hardness Constituents on the Acute Toxicity of Cadmium to Brook Trout (Salvelinus Fontinalis),
W79-09932 5C

ELMALKY, A. E.
Boron Distribution in Soils and Waters of Egypt,
W79-10073 2K

ELSEEWI, A. A.
Boron Distribution in Soils and Waters of Egypt,
W79-10073 2K

ENGSTROM, C. E.
Water Control and Distribution Apparatus,
W79-10032 5G

EPSTEIN, A. C.
Pretreatment of Seawater for Reverse Osmosis Processes: 1976,
W79-09831 3A

ERASMUS, T.
An Ecophysiological Study of the Meiofauna of the Swartkops Estuary. 3. Partition of Benthic Oxygen Consumption and the Relative Importance of the Meiofauna,
W79-09924 5C

EWALD, D.
Portable Water Filter,
W79-10077 5F

EWING, B. B.
Elements of a Water Quality Information System for the State of Illinois,
W79-09869 5A

FANGMEIER, D. D.
Intake Characteristics of Irrigation Furrows,
W79-09909 2G

FARRINGTON, J. W.
Fossil Fuel Compounds,
W79-10058 5C

FEDER, H. M.
Distribution and Abundance of Some Epibenthic Invertebrates of the Northeastern Gulf of Alaska with Notes on the Feeding Biology of Selected Species,
W79-10033 5C

FERGUSON, S. E.
Water Development in Wyoming: A Survey of Resident Attitudes, 1971,
W79-09833 6B

FIELD, R.
Nationwide Cost of Wet-Weather Pollution Control,
W79-09858 6B

FINDLAY, D. M.
Treatment of Mercury Contaminated Aqueous Media,
W79-10069 5D

FLANNAGAN, J. F.
Effects of Temperature and Cold Storage on Development Time and Viability of Eggs of the Burrowing Mayfly Hexagenia Rigida (Ephemeroptera: Ephemeridae),
W79-09919 5C

FLEMAL, R. C.
Elements of a Water Quality Information System for the State of Illinois,
W79-09869 5A

FLETCHER, G. L.
Reduction of Blood Plasma Copper Concentrations in a Marine Fish Following a Six Month Exposure to Crude Oil,
W79-09931 5C

FOX, G. B.
Lagoon Recharge of the Folkestone Beds at Hardham, Sussex--1972-75,
W79-09988 4B

FOX, W.
Low Picloram Concentrations in Streamflow Resulting from Forest Application of Tordon-10K,
W79-09864 5B

FRANK, M. D.
The Economic Value of Irrigation Water in the Western United States,
W79-10023 6B

FRIEDERICH, G. E.
Local and Mesoscale Influences on Nutrient Variability in the Northwest African Upwelling Region Near Cabo Corbeiro,
W79-09926 5C

FRIESEN, M. K.
Effects of Temperature and Cold Storage on Development Time and Viability of Eggs of the Burrowing Mayfly Hexagenia Rigida (Ephemeroptera: Ephemeridae),
W79-09919 5C

FRITH, C. F.
Statistical Interpretation of Membrane Filter Bacteria Counts,
W79-09885 7B

FUJIOKA, J. T.
Intertidal Biota and Subtidal Kelp Communities of the Kodiak Island Area,
W79-10035 5C

FURSTENBERG, J. P.
An Ecophysiological Study of the Meiofauna of the Swartkops Estuary. 3. Partition of Benthic Oxygen Consumption and the Relative Importance of the Meiofauna,
W79-09924 5C

GARTON, J. E.
Irrigation Water Conservation Using Wide-Spaced Furrows,
W79-10074 3F

GELDREICH, E. E.
A Layered Membrane Filter Medium for Improved Recovery of Stressed Fecal Coliforms,
W79-09895 7B

Performance Variability of Membrane Filter Procedures,
W79-09883 7B

GERWING, J. R.
Fertilizer Nitrogen Distribution Under Irrigation Between Soil, Plant, and Aquifer,
W79-10024 4B

GEURTSEN, A. A.
Apparatuses to Separate a Mixture of Liquids of Different Specific Gravities, E.G. Oil and Water,
W79-10028 5G

GHARRETT, J. A.
Intertidal Biota and Subtidal Kelp Communities of the Kodiak Island Area,
W79-10035 5C

GILL, R. JR.
Migration of Birds in Alaska Marine Habitats,
W79-10046 5C

GLANTZ, P. J.
A Comparison of Membrane Filters, Culture Media, Incubation Temperatures, Polluted Water and Escherichia Coli Strains in the Fecal Coliform Test,
W79-09893 7B

GLASGOW, R. M.
Monitoring the Temporal Dispersion of a Sewage Sludge Plume,
W79-10030 5C

GODDARD, N. H.
Critique on ASTM Test for Recovery of Fecal Coliforms and Proposal for Modified Method,
W79-09899 7B

GOODMAN, R. M.
Process for Scale Control Using Mixtures of Polycationic and Polyanionic Polymers,
W79-10072 3A

GOODROAD, L. L.
Fertilizer Nitrogen Distribution Under Irrigation Between Soil, Plant, and Aquifer,
W79-10024 4B

GORDON, D. C. JR.
Fossil Fuel Compounds,
W79-10058 5C

GORRIE, J.
What Price, Reject Heat,
W79-09868 6C

GRABOW, W. O. K.
Disinfection of Water: Pros and Cons,
W79-09845 5D

GRASSO, R. J.
Measurement of Fecal Coliforms in Estuarine Water,
W79-09896 7B

GREIG, R. A.
Trace Metal Uptake by Three Species of Mollusks,
W79-09933 5C

GRIMM, T.
Portable Water Filter,
W79-10077 5F

GROSS, M. G.
Dredging and Disposal of Its Large-Volume Waste,
W79-10052 5B

GROTH, W.
Process and System for Recovering Water from the Atmosphere,
W79-09940 2A

GUNNERSON, C. G.
Dredging and Disposal of Its Large-Volume Waste,
W79-10052 5B

GUZMAN, J.
Las Palmas Phase II Desalination Plant in the Canary Islands (Spain),
W79-09874 3A

HALL, G. C.
Modeling Water Distribution in Santa Clara County, Calif.,
W79-09877 4A

HAN, J.
Development of an Extension of ILLUDAS Model for Continuous Simulation of Urban Runoff Quantity and Discrete Simulation of Runoff Quality.
W79-09832 2A

HANDEL, C.
Migration of Birds in Alaska Marine Habitats,
W79-10046 5C

HANSCOM, J.
Sorting and Identification of Intertidal Samples,
W79-10036 5C

HANSEN, C. D.
Effect of Selenium Dioxide on the Accumulation and Acute Toxicity of Mercuric Chloride in Goldfish,
W79-09901 5C

HANSON, J. L.
Intertidal Biota and Subtidal Kelp Communities of the Kodiak Island Area,
W79-10035 5C

HARRIS, F. L.
Efficiency of Coliform Recovery Using Two Brands of Membrane Filters,
W79-09891 7B

HARRISON, F.
Artificial Radionuclides,
W79-10054 5C

HAWKES, J. W.
Pathology of Arctic and Subarctic Marine Species and Exposure to Trace Metals Associated with Petroleum,
W79-10042 5C

HAYCOCK, D.
What Price, Reject Heat,
W79-09868 6C

HEANEY, J. P.
Nationwide Cost of Wet-Weather Pollution Control,
W79-09858 6B

HEISINGER, J. F.
Effect of Selenium Dioxide on the Accumulation and Acute Toxicity of Mercuric Chloride in Goldfish,
W79-09901 5C

HENRY, F.
Dispersion in the Upper Delaware Estuary,
W79-10021 2L

HERMSMEIER, L. F.
Drainage Practice in Imperial Valley,
W79-09910 3C

HERN, S. C.
Distribution of Phytoplankton in South Dakota Lakes,
W79-10027 2H

HIBY, A. R.
The Development of the Eggs and Early Larvae of Blue Whiting, Micromeisistius Poutassou, and the Effect of Temperature on Development,
W79-09942 5C

HILBERT, M. S.
Aspects of Environmental Health Impacts of the Aswan High Dam on Rural Population in Egypt,
W79-10066 6G

HILDEBRAND, S. G.
Toxicity of Gallium and Beryllium to Developing Carp Eggs (Cyprinus Carpio) Utilizing Copper as a Reference,
W79-09958 5C

HOADLEY, A. W.
Effect of Injury on the Recovery of Indicator Bacteria on Membrane Filters,
W79-09886 7B

HODGINS, H. O.
Pathology of Arctic and Subarctic Marine Species and Exposure to Trace Metals Associated with Petroleum,
W79-10042 5C

HOFLE, M. G.
Effects of Sudden Temperature Shifts on Pure Cultures of Four Strains of Freshwater Bacteria,
W79-09948 5C

HOFSTEE, A. W. M.
Chlorophenols in Surface Waters of the Netherlands (1976-1977),
W79-09987 5A

HOOD, J. M.
Thermal Behavioral Responses of the Speckled Sanddab, Citharichthys Stigmaeus: Laboratory and Field Investigations,
W79-09945 5C

HOOD, M. J.
Thermal Behavioral Responses of Selected California Littoral Fishes,
W79-09946 5C

HOWARD, C. D. D.
An Analytic Approach to Scheduling Pipe Replacement,
W79-09879 6B

HOWARTH, R.
Biological Effects - A Generic View,
W79-10059 5C

HUBER, W. C.
Nationwide Cost of Wet-Weather Pollution Control,
W79-09858 6B

HUFHAM, J. B.
Effects of Temperature on the Recovery of Fecal Coliforms,
W79-09887 7B

HUGGETT, R.
Synthetic Organics,
W79-10050 5C

HUSSEIN, M.
Aspects of Environmental Health Impacts of the Aswan High Dam on Rural Population in Egypt,
W79-10066 6G

HUSSEINY, A. A.
Engineering Management of Nuclear Desalination Plants--A Case Study, Saudi Arabia,
W79-09872 3A

HUSSMANN, P.
Process and System for Recovering Water from the Atmosphere,
W79-09940 2A

INNISS, W. E.
A Direct Observation Technique for the Study of Microorganisms in Sediment Samples,
W79-09982 2J

IVARSON, K. C.
Nitrogen and Chloride Leaching in a Sandy Field Plot,
W79-09911 2G

IZATT, D.
Lagoon Recharge of the Folkestone Beds at Hardham, Sussex--1972-75,
W79-09988 4B

JACKSON, J. K.
Management of Water in Wessex,
W79-09861 6A

JACKSON, M. J.
The ASTM Proposed Membrane Filter Test Procedure for the Recovery of Fecal Coliforms,
W79-09898 7B

JAHN, S. A. A.
Studies on Natural Water Coagulants in the Sudan, with Special Reference to Moringa Oleifera Seeds,
W79-09844 5F

JAMJOOM, I.
The World's First Large Seawater Reverse Osmosis Desalination Plant, at Jeddah, Kingdom of Saudi Arabia,
W79-09873 3A

JENNE, E.
Biostimulants,
W79-10057 5C

JENSEN, M. E.
The Role of Evapotranspiration Models in Irrigation Scheduling,
W79-09914 2D

JEPPSON, R. W.
Developing a Computer Program for Distribution System Analysis,
W79-09876 4A

JEWETT, S. C.
Distribution and Abundance of Some Epibenthic Invertebrates of the Northeastern Gulf of Alaska with Notes on the Feeding Biology of Selected Species,
W79-10033 5C

JEZESKI, J. J.
Recovery Characteristics of Bacteria Injured in the Natural Aquatic Environment,
W79-09894 7B

JOHNSON, R. W.
Monitoring the Temporal Dispersion of a Sewage Sludge Plume,
W79-10030 5C

JOLLEY, R. L.
Chlorination Products,
W79-10051 5C

JONES, J. W.
Subsidence Related to Land Use in Everglades Agricultural Area,
W79-09968 4A

JUDY, R. D. JR.
Effects of Calcium Addition as Ca(NO3)2 on Zinc Toxicity to Fathead Minnows, Pimephales Promelas, Rafinesque,
W79-09928 5C

JUMARS, P.
Biological Effects - A Generic View,
W79-10059 5C

KARMELI, D.
Estimating Sprinkler Distribution Patterns Using Linear Regression,
W79-09915 3F

Procedure for the Economical Evaluation of Water Networks' Parameters,
W79-09866 6A

KASPRZAK, K.
Effects of Artificial Rise of Temperature on Stagnant Waters and Their Biocenoses,
W79-09960 5C

KAVIA, Z. D.
Sprinkler in the Desert,
W79-10079 3F

KEFLEMARIAM, J.
Irrigation Water Conservation Using Wide-Spaced Furrows,
W79-10074 3F

KELLERMANN, W.
Electrochemical Determination of Heavy Metals in Water and Apparatus Therefor,
W79-09935 5A

KESTING, R. E.
Development of Dry Process Microporous Polysulfone Supports for Ultrathin Film Composites,
W79-09839 3A

KICENIUK, J. W.
Reduction of Blood Plasma Copper Concentrations in a Marine Fish Following a Six Month Exposure to Crude Oil,
W79-09931 5C

KIM, J. H.
Effect of Selenium Dioxide on the Accumulation and Acute Toxicity of Mercuric Chloride in Goldfish,
W79-09901 5C

KING, J. G.
Water Quality Characteristics of the Horse Creek Watersheds in North Central Idaho,
W79-09838 2A

KING, M. J.
Reduction of Blood Plasma Copper Concentrations in a Marine Fish Following a Six Month Exposure to Crude Oil,
W79-09931 5C

KINZER, G. R.
The ASTM Proposed Membrane Filter Test Procedure for the Recovery of Fecal Coliforms,
W79-09898 7B

KOLASA, J.
Effects of Artificial Rise of Temperature on Stagnant Waters and Their Biocenoses,
W79-09960 5C

KORIS, K.
Regulation Model of the Lake Velence Reservoir System,
W79-09852 6A

KOWALENKO, C. G.
Nitrogen and Chloride Leaching in a Sandy Field Plot,
W79-09911 2G

KREBS, J. E.
Budgets of Selected Natural Mineral Nutrients for a Southeastern Piedmont Forest and Pasture,
W79-09927 5C

KREITLER, C. W.
Nitrogen-Isotope Ratio Studies of Soils and Groundwater Nitrate from Alluvial Fan Aquifers in Texas,
W79-09983 5B

KRISTOFFERSSON, R.
Factors Affecting the Burrowing Activity of Macoma Balthica (L.),
W79-09959 5C

KUDO, A.
Pathways for Mercury Uptake by Fish from Bed Sediments,
W79-09918 5B

KUHAIDA, A. J.
The Prediction of Mean Monthly Soil Temperature from Mean Monthly Air Temperature,
W79-09906 2A

KUNISADA, Y.
Long Term Experiments on Sea Water Desalination at the Chigasaki Laboratory,
W79-09871 3A

LACEWELL, R. D.
The Economic Value of Irrigation Water in the Western United States,
W79-10023 6B

LAMBOU, V. W.
Distribution of Phytoplankton in Louisiana Lakes,
W79-10026 2H

Distribution of Phytoplankton in South Dakota Lakes,
W79-10027 2H

LANDA, E. R.
Soil Water Content and Temperature as Factors in the Volatile Loss of Applied Mercury (II) from Soils,
W79-09916 2K

LARSEN, D. P.
Biostimulants,
W79-10057 5C

LASETER, J. L.
Fossil Fuel Compounds,
W79-10058 5C

LASKER, R.
Biostimulants,
W79-10057 5C

LASKIN, A. I.
Use of Microorganisms in Combination with Surface Active Agents to Synergistically Disperse Oil Slicks,
W79-09930 5G

LAUENROTH, W. K.
Response of Native Grassland Legumes to Water and Nitrogen Treatments,
W79-10071 2I

LAWRENCE, S. G.
Effects of Temperature and Cold Storage on Development Time and Viability of Eggs of the Burrowing Mayfly Hexagenia Rigida (Ephemeroptera: Ephemeridae),
W79-09919 5C

LIN, S.
Evaluation of Methods for Detecting Coliforms and Fecal Streptococci in Chlorinated Secondary Sewage Effluents,
W79-09897 7B

LITCHFIELD, C. D.
Microorganisms,
W79-10055 5C

LITSKY, W.
A Layered Membrane Filter Medium for Improved Recovery of Stressed Fecal Coliforms,
W79-09895 7B

A Simplified Method for the Simulataneous Extraction of Phytoplanktonic Chlorophyll and Fecal Sterol from Water,
W79-09979 5A

LOHANI, B. N.
A Multiobjective Model for Regional Water Quality Management,
W79-09867 6A

Probabilistic Water Quality Control Policies,
W79-09857 6A

LONG, R. B.
Income Distribution Impacts of a Water Development Project--Boise Project, Idaho, 1950-1970,
W79-09865 6B

LONKERD, W. E.
Salinity Profiles and Leaching Fractions for Slowly Permeable Irrigated Field Soils,
W79-10075 2G

LONSDALE, E.
Experimental Control of Beach Face Dynamics by Watertable Pumping,
W79-09971 2L

MACEK, K.
Synthetic Organics,
W79-10050 5C

MALINS, D. C.
Metabolism of Trace Metals: Bioaccumulation and Biotransformation in Marine Organisms,
W79-10043 5C

MANCY, K. H.
Aspects of Environmental Health Impacts of the Aswan High Dam on Rural Population in Egypt,
W79-10066 6G

MARCHYULENENE, E. D. P.
Exchange of Certain Radionuclides Between the Environment and Fresh-Water Algae,
W79-09923 5C

MARTIG, K. W. JR.
Flow Monitoring,
W79-09936 8B

MARTIN, D. G.
A Mathematical Model of Stratified, Bidirectional Flow in Short Culverts,
W79-09835 2A

MARTIN, J.
Trace Metals,
W79-10056 5C

MASIAK, D.
Sorting and Identification of Intertidal Samples,
W79-10036 5C

MATTICE, J. S.
Effect of a Steam Electric Generating Station on the Emergence Timing of the Mayfly, Hexagenia Bileneata,
W79-09949 5C

MATTSON, M. T.
Distribution Patterns and Population Dynamics of Polyphemus Pediculus (L.) (Crustacea, Cladocera) in a Small New England Lake,
W79-09836 2H

MAYEWSKI, P. A.
Pattern of Ice Surface Lowering for Rennick Glacier, Northern Victoria Land, Antarctica,
W79-09974 2C

MAYFIELD, C. I.
A Direct Observation Technique for the Study of Microorganisms in Sediment Samples,
W79-09982 2J

MCALLISTER, I.
V-Shaped Oil Containment Boom,
W79-09937 5G

MCBEAN, E.
What Price, Reject Heat,
W79-09868 6C

MCCAIN, B.
Biological Effects - A Generic View,
W79-10059 5C

MCCUEN, R. H.
Comparative Evaluation of Statistical Methods for Water Supply Forecasting,
W79-09870 2E

MCFETERS, G. A.
Comparison of Membrane Filters in Recovery of Naturally Injured Coliforms,
W79-09890 7B

Recovery Characteristics of Bacteria Injured in the Natural Aquatic Environment,
W79-09894 7B

MCGOWEN, G. E.
Thermal Behavioral Responses of Selected California Littoral Fishes,
W79-09946 5C

MCLEAN, R. A. N.
Treatment of Mercury Contaminated Aqueous Media,
W79-10069 5D

MCSWAIN, M. R.
Fluctuations in Naturally Occurring Populations of Enteric Bacteria in Oligotrophic Streams of Western North Carolina,
W79-09902 5A

MEIER, W. L. JR.
Heuristic Decision Rules for Water Resources Planning,
W79-09962 6A

METCALF, T. G.
Microorganisms,
W79-10055 5C

MICKELSON, P. G.
Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-10047 5C

MIDDLEDITCH, B. S.
Alkanes in Seawater in the Vicinity of the Buccaneer Oilfield,
W79-09905 5B

MILLER, A. J.
A Cloud-Seeding Experiment in Tasmania,
W79-09963 2B

MILLER, B. R.
Anthropological Investigations Near the Crest of the Continent, 1975-1978,
W79-09840 6G

MILLER, F. D.
Aspects of Environmental Health Impacts of the Aswan High Dam on Rural Population in Egypt,
W79-10066 6G

MILLER, R. L.
Spatial Correlations of Monthly Rainfall: Applications in Climatology and Weather Modification Experiments,
W79-09964 2B

MINSHALL, G. W.
Autotrophy in Stream Ecosystems,
W79-09922 5C

MISHOE, J. W.
Subsidence Related to Land Use in Everglades Agricultural Area,
W79-09968 4A

MODELL, M.
Wastewater Treatment with Desorbing of an Adsorbate from an Adsorbent with a Solvent in the Near Critical State,
W79-09929 5D

MOHAN, R. R.
Use of Microorganisms in Combination with Surface Active Agents to Synergistically Disperse Oil Slicks,
W79-09930 5G

MOORE, S. F.
Water Quality Sampling Programs in Rivers,
W79-09859 5A

MORIN, T. L.
Heuristic Decision Rules for Water Resources Planning,
W79-09962 6A

MORRIS, B. F.
Litter,
W79-10053 5B

MORRIS, F. A.
Distribution of Phytoplankton in Louisiana Lakes,
W79-10026 2H

Distribution of Phytoplankton in South Dakota Lakes,
W79-10027 2H

MORRIS, M. K.
Distribution of Phytoplankton in Louisiana Lakes,
W79-10026 2H

Distribution of Phytoplankton in South Dakota Lakes,
W79-10027 2H

MORTIMER, D. C.
Pathways for Mercury Uptake by Fish from Bed Sediments,
W79-09918 5B

MUELLER, G.
Sorting and Identification of Intertidal Samples,
W79-10036 5C

MUNSON, B. E.
The Prediction of Mean Monthly Soil Temperature from Mean Monthly Air Temperature,
W79-09906 2A

MURAYAMA, Y.
Long Term Experiments on Sea Water Desalination at the Chigasaki Laboratory,
W79-09871 3A

MURCHELANO, R. A.
Microorganisms,
W79-10055 5C

MUSZYNSKI, G.
Thermal Behavioral Responses of Selected California Littoral Fishes,
W79-09946 5C

Thermal Behavioral Responses of the Speckled Sanddab, Citharichthys Stigmaeus: Laboratory and Field Investigations,
W79-09945 5C

MYHRE, D. L.
Cation Exchange Equilibria in Florida and Indiana Histosols,
W79-09912 2K

Subsidence Related to Land Use in Everglades Agricultural Area,
W79-09968 4A

NAGABHUSHANAM, R.
Laboratory Studies on the Direct Effect of Temperature on the Freshwater Vector Snail, Indoplanorbis Exustus (Deshyes),
W79-09934 5C

NAGY, B.
Regulation Model of the Lake Velence Reservoir System,
W79-09852 6A

NASLUND, L. A.
Use of Microorganisms in Combination with Surface Active Agents to Synergistically Disperse Oil Slicks,
W79-09930 5G

NEARY, D. G.
Low Picloram Concentrations in Streamflow Resulting from Forest Application of Tordon-10K,
W79-09864 5B

NELSON, T.
Income Distribution Impacts of a Water Development Project--Boise Project, Idaho, 1950-1970,
W79-09865 6B

NICHOLS, M. N.
Dredging and Disposal of Its Large-Volume Waste,
W79-10052 5B

NILSSON, C.
Changes in the Aquatic Flora Along a Stretch of the River Umealven, N. Sweden, Following Hydroelectric Exploitation,
W79-09957 5C

NISCHIK, H.
Electrochemical Determination of Heavy Metals in Water and Apparatus Therefor,
W79-09935 5A

NORISUGI, M.
Pump-Type Sludge Dredging Apparatus,
W79-10017 5E

NUTTER, W. L.
Consequences of Harvesting and Site Preparation in the Piedmont,
W79-09878 5A

NYBERG, D.
The Effect of Temperature on Copper Tolerance of Paramecium,
W79-09903 5C

ODEN, B. J.
The Freshwater Littoral Meiofauna in a South Carolina Reservoir Receiving Thermal Effluents,
W79-09950 5C

OLIVER, W. S.
Influences of Hardness Constituents on the Acute Toxicity of Cadmium to Brook Trout (Salvelinus Fontinalis),
W79-09932 5C

OLSYNA-MARZYS, A. E.
Mercury Contamination of Fish in Guatemala,
W79-09939 5C

OMORI, M.
Growth, Feeding and Mortality of Larval and Early Postlarval Stages of the Oceanic Shrimp Sergestes Similis Hansen,
W79-09951 5C

OMOTI, U.
Use of Fluorescent Dyes to Mark the Pathways of Solute Movement through Soils under Leaching Conditions: 1. Laboratory Experiments,
W79-09976 2G

OPHEL, I.
Artificial Radionuclides,
W79-10054 5C

ORON, G.
Procedure for the Economical Evaluation of Water Networks' Parameters,
W79-09866 6A

ORTOLANO, L.
Modeling Water Distribution in Santa Clara County, Calif.,
W79-09877 4A

OSTER, J. D.
Infiltration as Influenced by Irrigation Water Quality,
W79-09989 5C

PARKER, C. D.
Low Cost Methods of Treatment of Agricultural Effluents in Warm Climates,
W79-10068 5D

PARKER, J. C.
Water Development in Wyoming: A Survey of Resident Attitudes, 1971,
W79-09833 6B

PARSONS, J. E.
Water Requirements and Water Table Variations for a Controlled and Reversible Drainage System,
W79-09966 2G

PATRIC, J. H.
Can Forest Land Produce Wood, Recreation, and High Quality Water Too,
W79-09851 4C

Some Effects of Urea Fertilization on a Forested Watershed in West Virginia,
W79-09847 2K

PATRINOS, A. A. N.
Spatial Correlations of Monthly Rainfall: Applications in Climatology and Weather Modification Experiments,
W79-09964 2B

PAYNE, J. F.
Reduction of Blood Plasma Copper Concentrations in a Marine Fish Following a Six Month Exposure to Crude Oil,
W79-09931 5C

PEREYRA, W. T.
Baseline Studies of the Demersal Resources of the Eastern and Western Gulf of Alaska Shelf and Slope: A Historical Review,
W79-10037 5C

PERSSON, L.
The Effects of Temperature and Different Food Organisms on the Rate of Gastric Evacuation in Perch (Perca Fluviatilis),
W79-09952 5C

PESKIN, R. L.
Dispersion in the Upper Delaware Estuary,
W79-10021 2L

PETERSEN, M.
Migration of Birds in Alaska Marine Habitats,
W79-10046 5C

PETERSON, G. L.
Mid-Eocene Climatic Change, Southwestern California and Northwestern Baja California,
W79-10076 2B

PEYTON, L. J.
Avian Community Ecology of the Akulik-Inglutalik River Delta, Norton Bay, Alaska,
W79-10048 5C

PHILLIPS, C.
Water Development in Wyoming: A Survey of Resident Attitudes, 1971,
W79-09833 6B

POLONENKO, D. R.
A Direct Observation Technique for the Study of Microorganisms in Sediment Samples,
W79-09982 2J

POPESCU, M. E.
Engineering Problems Associated with Expansive Clays from Romania,
W79-09972 2G

POWER, D. A.
Quality Control of Membrane Filter Media,
W79-09884 7B

PRIOR, D. B.
Application of Infinite Slope Analysis to Subaqueous Sediment Instability, Mississippi Delta,
W79-09970 2L

PRONI, J. R.
Monitoring the Temporal Dispersion of a Sewage Sludge Plume,
W79-10030 5C

QUINN, J. G.
Fossil Fuel Compounds,
W79-10058 5C

QVENILD, C.
Methodology of Studies on Chemical Processes in Water Runoff from Rock and Shallow Soil Cover Using Radioactive Tracers,
W79-09980 2K

RAMOS, A.
Mercury Contamination of Fish in Guatemala,
W79-09939 5C

RAMSEY, M. K.
Intake Characteristics of Irrigation Furrows,
W79-09909 2G

RAMSEY, R. H.
A Study of the Reuse of Reused Water,
W79-09846 3C

RAWLS, W. J.
Comparative Evaluation of Statistical Methods for Water Supply Forecasting,
W79-09870 2E

RAYMOND, C. F.
Grain Coarsening of Water-Saturated Snow,
W79-09975 2C

RECKHOW, K. H.
Uncertainty Analysis Applied to Vollenweider's Phosphorus Loading Criterion,
W79-09856 5A

REED, S. E.
The Distribution and Seasonality of the Benthic Aquatic Macrophytes of the Pamlico River Estuary, North Carolina,
W79-09834 2L

REEVES, H. E.
Irrigation Water Conservation Using Wide-Spaced Furrows,
W79-10074 3F

REICHERT, W. L.
Behavioral and Physiological Effects Induced by Sublethal Levels of Heavy Metals,
W79-10044 5C

REINERT, R.
Synthetic Organics,
W79-10050 5C

RHO, J.
A Simplified Method for the Simulataneous Extraction of Phytoplanktonic Chlorophyll and Fecal Sterol from Water,
W79-09979 5A

RISEBROUGH, R.
Synthetic Organics,
W79-10050 5C

ROBBINS, M. L.
Use of Microorganisms in Combination with Surface Active Agents to Synergistically Disperse Oil Slicks,
W79-09930 5G

RONGVED, P. I.
Closed Spiral Path Waste Water Treatment System,
W79-09947 5D

RONHOLT, L. L.
Baseline Studies of the Demersal Resources of the Eastern and Western Gulf of Alaska Shelf and Slope: A Historical Review,
W79-10037 5C

ROSE-ACKERMAN, S.
Market Models for Water Pollution Control: Their Strengths and Weaknesses,
W79-10016 6E

ROSE, R. E.
A Layered Membrane Filter Medium for Improved Recovery of Stressed Fecal Coliforms,
W79-09895 7B

ROSENTHAL, R. J.
Preliminary Observations on the Distribution Abundance and Food Habits of Some Nearshore Fishes in the Northeastern Gulf of Alaska,
W79-10039 5C

ROSS, R.
Scheduling Trims Back Water Use by 7.3 Inches per Acre,
W79-10070 3F

ROUX, C.
The Influence of Some Ecological Factors on the Metabolism-Temperature Curve of the Larvae of Limnephilus Rhombicus, (Trichoptera, Limnephilidae),
W79-09953 5C

SALO, E. A.
Apparatus and Method for Controlling Tide Waters,
W79-09938 8A

SANBORN, H. R.
General Effects of Metals on the Ecosystem,
W79-10045 5C

SCHAMEL, D.
Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-10047 5C

SCHIEMAN, D. A.
A Comparison of Membrane Filters and Media Used to Recover Coliforms from Water,
W79-09889 7B

SCHILLINGER, J. E.
Comparison of Membrane Filters in Recovery of Naturally Injured Coliforms,
W79-09890 7B

SCHROER, F. W.
Infiltration as Influenced by Irrigation Water Quality,
W79-09989 5C

SEATON, R.
The World's First Large Seawater Reverse Osmosis Desalination Plant, at Jeddah, Kingdom of Saudi Arabia,
W79-09873 3A

SEESMAN, P. A.
Comparison of Membrane Filter Counts and Plate Counts on Heterotrophic and Oil Agar Used to Estimate Populations of Yeast, Fungi and Bacteria,
W79-09900 7B

SEGERSTRALE, S. G.
Upper Limits of the Depth Range and Temperature Tolerance of the Baltic Pontoporeia Affinis (Crustacea, Amphipoda),
W79-09956 5C

SEGUIN, A.
Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-10047 5C

SEIP, H. M.
Methodology of Studies on Chemical Processes in Water Runoff from Rock and Shallow Soil Cover Using Radioactive Tracers,
W79-09980 2K

SHAMIR, U.
An Analytic Approach to Scheduling Pipe Replacement,
W79-09879 6B

SHANDELMEIER, L.
Sorting and Identification of Intertidal Samples,
W79-10036 5C

SHARMA, H. D.
Canal Seepage with Boundary at Finite Depth,
W79-09990 2G

SHARMA, T. C.
Time of Spread Relationship in Irrigation Check Basins,
W79-09917 2G

SHAW, D. E.
A Cloud-Seeding Experiment in Tasmania,
W79-09963 2B

SHEELY, M.
Rainfall in Southern California,
W79-10078 2B

SHIELDS, G. F.
Avian Community Ecology of the Akulik-Inglutalik River Delta, Norton Bay, Alaska,
W79-10048 5C

SHIH, S. F.
Subsidence Related to Land Use in Everglades Agricultural Area,
W79-09968 4A

SHULL, H.
Traveling Boom Sprinkler Operation in Wind,
W79-09967 3F

SHYU, J. Y.
System for Collecting Oil,
W79-09969 5G

SIMPSON, J.
Artificial Radionuclides,
W79-10054 5C

SINGH, P.
Sprinkler in the Desert,
W79-10079 3F

SINGH, V. P.
The Role of Computers in Transfer of Water Resource Technology,
W79-09853 6A

SLADEK, K. J.
Optimum Membrane Structures for Growth of Fecal Coliform Organisms,
W79-09888 7B

Statistical Interpretation of Membrane Filter Bacteria Counts,
W79-09885 7B

SMALL, R. J.
The Formation of Medial Moraines on Alpine Glaciers,
W79-09973 2C

SMITH, D. W.
Some Effects of Urea Fertilization on a Forested Watershed in West Virginia,
W79-09847 2K

SMITH, E. D.
A Study of the Reuse of Reused Water,
W79-09846 3C

SMITH, E. J.
A Cloud-Seeding Experiment in Tasmania,
W79-09963 2B

SMITH, R.
Water Analysis in South Africa: Interlaboratory Comparison Studies, Part IV: Mineral Analysis,
W79-09841 9C

SNIEDOVICH, M.
Analysis of Investments in Technology Development and Resource Conservation,
W79-09854 6B

SOHN, B. I.
Optimum Membrane Structures for Growth of Fecal Coliform Organisms,
W79-09888 7B

SPENCER, L.
Multiple Emitter Flow Control,
W79-10018 3F

STEEN, J. W.
V-Shaped Oil Containment Boom,
W79-09937 5G

STEGEMAN, J.
Biological Effects - A Generic View.
W79-10059 5C

STEHFEST, H.
On the Monetary Value of an Ecological River Quality Model,
W79-09863 6A

STEPHENS, J. S.
Thermal Behavioral Responses of the Speckled Sanddab, Citharichthys Stigmaeus: Laboratory and Field Investigations,
W79-09945 5C

STERN, P. H.
Rural Water Development in Arid Regions,
W79-10065 6G

STEVENS, A. P.
Measurement of Fecal Coliforms in Estuarine Water,
W79-09896 7B

STICKEL, L. F.
Ecological and Physiological/Toxicological Effects of Petroleum on Aquatic Birds. A Summary of Research Activities FY 76 Through FY 78,
W79-10031 5C

STONE, J. F.
Irrigation Water Conservation Using Wide-Spaced Furrows,
W79-10074 3F

STUANES, A.
Interaction Between Simulated Rain and Barren Rock Surface,
W79-09981 2K

STUART, D. G.
Comparison of Membrane Filters in Recovery of Naturally Injured Coliforms,
W79-09890 7B

Recovery Characteristics of Bacteria Injured in the Natural Aquatic Environment,
W79-09894 7B

STURM, F. V.
Electrochemical Determination of Heavy Metals in Water and Apparatus Therefor,
W79-09935 5A

SUHAYDA, J. N.
Application of Infinite Slope Analysis to Subaqueous Sediment Instability, Mississippi Delta,
W79-09970 2L

SULLIVAN, R. H.
Nationwide Cost of Wet-Weather Pollution Control,
W79-09858 6B

SUSLAVICH, R. V.
Optimum Membrane Structures for Growth of Fecal Coliform Organisms,
W79-09888 7B

SWANK, W. T.
Fluctuations in Naturally Occurring Populations of Enteric Bacteria in Oligotrophic Streams of Western North Carolina,
W79-09902 5A

SWANSON, R. L.
Litter,
W79-10053 5B

SWEAZY, R. M.
A Study of the Reuse of Reused Water,
W79-09846 3C

SWIERCINSKY, G. L.
Water Control and Distribution Apparatus,
W79-10032 5G

SZETO, C.
The Effect of Temperature on Copper Tolerance of Paramecium,
W79-09903 5C

TAGUE, M.
Lagoon Recharge of the Folkestone Beds at Hardham, Sussex--1972-75,
W79-09988 4B

TAKEUCHI, D. M.
Changes in Cloud Base Precipitation Particle Size-Distributions as a Response Variable to Seeding,
W79-10025 2B

TAYLOR, W. D.
Distribution of Phytoplankton in Louisiana Lakes,
W79-10026 2H

Distribution of Phytoplankton in South Dakota Lakes,
W79-10027 2H

TEAL, J.
Biological Effects - A Generic View,
W79-10059 5C

TEMPLETON, W. L.
Artificial Radionuclides,
W79-10054 5C

THANH, N. C.
Probabilistic Water Quality Control Policies,
W79-09857 6A

THATCHER, T. O.
A Morphological Defect in Shiner Perch Resulting from Chronic Exposure to Chlorinated Sea Water,
W79-09907 5C

TOERIEN, D. F.
The Chemical Composition of the Upper Hennops River and its Implications on the Water Quality of Rietvlei Dam,
W79-09843 5A

TOLLAN, O.
Methodology of Studies on Chemical Processes in Water Runoff from Rock and Shallow Soil Cover Using Radioactive Tracers,
W79-09980 2K

TOY, T. J.
The Prediction of Mean Monthly Soil Temperature from Mean Monthly Air Temperature,
W79-09906 2A

TRABALKA, J. R.
Effects of Water-Soluble Chlorine-Containing Organics on Aquatic Environments--Another Perspective,
W79-09954 5C

TRACY, D.
Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-10047 5C

TREYSSAC, G. M.
Process and Apparatus for Separating Matter in Suspension in a Liquid,
W79-09941 5D

TUSIMA, K.
Grain Coarsening of Water-Saturated Snow,
W79-09975 2C

VAIDYA, D. P.
Laboratory Studies on the Direct Effect of Temperature on the Freshwater Vector Snail, Indoplanorbis Exustus (Deshyes),
W79-09934 5C

VARANASI, U.
Metabolism of Trace Metals: Bioaccumulation and Biotransformation in Marine Organisms,
W79-10043 5C

VEITCH, L. G.
A Cloud-Seeding Experiment in Tasmania,
W79-09963 2B

VERKHOVSKY, B. S.
Analysis of Investments in Technology Development and Resource Conservation,
W79-09854 6B

VICHNEVETSKY, R.
Dispersion in the Upper Delaware Estuary,
W79-10021 2L

WALKER, J. D.
Comparison of Membrane Filter Counts and Plate Counts on Heterotrophic and Oil Agar Used to Estimate Populations of Yeast, Fungi and Bacteria,
W79-09900 7B

WALKER, R. D.
Concentrations of Nitrilotriacetate and Certain Metals in Canadian Wastewaters and Streams: 1971-1975,
W79-09986 5B

WALKER, R. W.
A Simplified Method for the Simulataneous Extraction of Phytoplanktonic Chlorophyll and Fecal Sterol from Water,
W79-09979 5A

WALMSLEY, R. D.
The Chemical Composition of the Upper Hennops River and its Implications on the Water Quality of Rietvlei Dam,
W79-09843 5A

WEBB, B. B.
Irrigation Water Conservation Using Wide-Spaced Furrows,
W79-10074 3F

WEGMAN, R. C. C.
Chlorophenols in Surface Waters of the Netherlands (1976-1977),
W79-09987 5A

WHALEY, B. L.
Comparative Evaluation of Statistical Methods for Water Supply Forecasting,
W79-09870 2E

WHETSTONE, G. A.
A Study of the Reuse of Reused Water,
W79-09846 3C

WILD, A.
Use of Fluorescent Dyes to Mark the Pathways of Solute Movement through Soils under Leaching Conditions: 1. Laboratory Experiments,
W79-09976 2G

WILKIN, D. C.
Elements of a Water Quality Information System for the State of Illinois,
W79-09869 5A

WILLIAMS, L. R.
Distribution of Phytoplankton in Louisiana Lakes,
W79-10026 2H

WOOD, W. W.
Use of Baker's Yeast to Trace Microbial Movements in Ground Water,
W79-09855 5B

WOODIWISS, C. R.
Concentrations of Nitrilotriacetate and Certain Metals in Canadian Wastewaters and Streams: 1971-1975,
W79-09986 5B

WOODWARD, B. L.
Anthropological Investigations Near the Crest of the Continent, 1975-1978,
W79-09840 6G

WRIGHT, J. L.
The Role of Evapotranspiration Models in Irrigation Scheduling,
W79-09914 2D

WUN, C. K.
A Simplified Method for the Simulataneous Extraction of Phytoplanktonic Chlorophyll and Fecal Sterol from Water,
W79-09979 5A

YOUNG, D.
Trace Metals,
W79-10056 5C

ZIMMERMAN, S. T.
Intertidal Biota and Subtidal Kelp Communities of the Kodiak Island Area,
W79-10035 5C

TAGUE, M.
Hydrogeologic Data for the Tucson Basin, Arizona
Quality Model, ... W79-09988

TAKEUCHI, D. M.
Changes in Natural Soil Properties Under Surface Disturbance and Revegetation
Seeding and Field Investigation, ... W79-10025

TAYLOR, W. D.
Depletion and Replenishment of Nutrients in Lentic Waters, ... W79-10027

TEAL, J.
Ecological Effects of Oil Pollution on Littoral Salt Marsh Communities, ... W79-10021

THEAKSTON, W. J.
Artificial Recharge, ... W79-10024

THANN, N. C.
Groundwater Quality Control Problems, ... W79-09977

THEODOR, T. O.
A Morphological Index of Saline Area Reclamation Success Evaluated by Chlorinated Hydrocarbon Residues in Soil, ... W79-09967

TOERIEN, D. F.
The Chemical Composition of the Upper Vaal River and Its Tributaries, ... W79-09967

TOLLAN, O.
Effects of Sewage on Chemical Properties of Water Found from Rock and Shallow Soil Over Deep Bedrock, ... W79-09967

TOY, T. J.
The Problem of Man Made Materials from Long Term Mining, ... W79-09967

TRELEASE, S. F.
Effect of Water-Stable Chlorine Containing Organic Matter, ... W79-09967

TRACY, D.
Arsenic Compounds Control of Water Hyacinth, ... W79-10027

TREYSSAC, C. M.
Water Quality Effects of Land Disposal of Coal Processing Wastes, ... W79-10027

TRIEMA, A.
Ohio Coal Mine Subsidence, ... W79-10027

TRUDA, D. R.
Phosphorus Removal by Lime Clarification of Treated Sewage, ... W79-10027

VARANAUS, G.
Hydrogeologic Data for the Tucson Basin, Arizona, ... W79-09988

VELDHOVEN, J. V.
A Chemical Survey of Groundwater Quality in Ontario, ... W79-10027

VERMEULEN, P. D.
Groundwater Quality Control Problems, ... W79-09977

VICHNEVETSKY, R.
Computer Modeling and Simulation of Groundwater Flow, ... W79-10027

WAGNER, R. J.
Water Quality Effects of Land Disposal of Coal Processing Wastes, ... W79-10027

WALKER, R. D.
Concentration of Nutrients and Certain Metals in Groundwater Supplies, ... W79-09988

WALKER, R. W.
A Simplified Method for the Simultaneous Determination of Phytoplankton Chlorophyll and Total Phosphorus, ... W79-09979

WALKLEY, R. D.
The Chemical Composition of the Upper Vaal River and Its Tributaries, ... W79-09967

WEIR, R. E.
Irrigation Water Conservation Using Sprayed Furrows, ... W79-10024

WERNER, R. C.
Chlorophenols in Surface Waters of Canada, ... W79-09967

WHALEY, R. L.
Comparative Evaluation of Statistical Methods for Water Supply Forecasting, ... W79-10027

WHITSTONE, G. A.
A Study of the Reuse of Reused Water, ... W79-09988

WILD, A.
Role of Decomposed Dyes in Plant Physiology, ... W79-09967

WILKEN, R. E.
Elements of a Water Quality Management Plan for the Gulf of Mexico, ... W79-09988

WILLIAMS, J. R.
Chemical Transport by Runoff, ... W79-10025

WOOD, W. W.
Use of Radon in Tracing Groundwater Movement, ... W79-09977

WOODWARD, C. R.
Concentrations of Phosphorus and Calcium in Canadian Waterways, ... W79-09967

WOODWARD, E. L.
Archeological Investigations Near the Coast of the Continent, 1972-1975, ... W79-09988

WRIGHT, L. L.
The Role of Phosphorus in Marine Phytoplankton Nutrition, ... W79-09967

YEARSLEY, B. S.
Analysis of Parameters in Tracking Dye Dispersion and Reservoir Conservation, ... W79-09988

YOCHUM, D.
Dispersion in the Upper Delaware River, ... W79-10027

ZIMMERMAN, E. T.
Insecticide Uses and Natural Role Compounds of the Rocky Island Alkali, ... W79-10027

ORGANIZATIONAL INDEX

ACTIVOX, INC., NEW YORK. (ASSIGNEE).
Closed Spiral Path Waste Water Treatment System,
W79-09947 5D

AGRICULTURAL RESEARCH AND EDUCATION CENTER, BELLE GLADE, FL.
Subsidence Related to Land Use in Everglades Agricultural Area,
W79-09968 4A

AKADEMIYA NAUK LITOVSKOI SSR, VILNIUS. INST. OF BOTANY.
Exchange of Certain Radionuclides Between the Environment and Fresh-Water Algae,
W79-09923 5C

ALASKA COASTAL RESEARCH, HOMER.
Preliminary Observations on the Distribution Abundance and Food Habits of Some Nearshore Fishes in the Northeastern Gulf of Alaska,
W79-10039 5C

ALASKA DEPT. OF FISH AND GAME, ANCHORAGE.
Finfish Resource Surveys in Norton Sound and Kotzebue Sound,
W79-10034 5C

ALASKA DEPT. OF FISH AND GAME, FAIRBANKS. DIV. OF SPORT FISH.
Beaufort Sea Estuarine Fishery Study,
W79-10038 5C

ALASKA UNIV., FAIRBANKS. INST. OF ARCTIC BIOLOGY.
Avian Community Ecology at Two Sites on Espenberg Peninsula in Kotzebue Sound, Alaska,
W79-10047 5C

Avian Community Ecology of the Akulik-Inglutalik River Delta, Norton Bay, Alaska,
W79-10048 5C

ALASKA UNIV., FAIRBANKS. INST. OF MARINE SCIENCE.
Distribution and Abundance of Some Epibenthic Invertebrates of the Northeastern Gulf of Alaska with Notes on the Feeding Biology of Selected Species,
W79-10033 5C

AMERICAN CYANAMID CO., SAMFORD, CT. (ASSIGNEE).
Process for Scale Control Using Mixtures of Polycationic and Polyanionic Polymers,
W79-10072 3A

ARIZONA UNIV., TUCSON. DEPT. OF SOILS, WATER AND ENGINEERING.
Intake Characteristics of Irrigation Furrows,
W79-09909 2G

ARMY ENGINEER DISTRICT, ALBUQUERQUE, NM.
Flood Plain Information: Pojoaque River and Tributaries, Santa Fe County, New Mexico,
W79-10012 2E

Flood Plain Information: Mimbres River and Florida Gap Draw, Deming, Luna County, NM.
W79-10013 2E

ARMY ENGINEER DISTRICT, FORT WORTH, TX.
Wastewater Management Plan. Colorado River and Tributaries, Texas. Summary,
W79-10020 5G

ARMY ENGINEER DISTRICT, WALTHAM, MA. NEW ENGLAND DIV.
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 8: Urban Stormwater Management,
W79-10000 5F

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13: Impact Analysis and Evaluation,
W79-10005 6G

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13A: Biological Impact Analysis,
W79-10006 6C

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13B: Socio-Economic Impact Analysis,
W79-10007 6B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13C: Hygienic Impact Analysis,
W79-10008 5F

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 13D: Visual, Cultural and Design Impact Analysis,
W79-10009 6B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 14: Public Involvement,
W79-10010 6B

ASIAN INST. OF TECH., BANGKOK (THAILAND).
Probabilistic Water Quality Control Policies,
W79-09857 6A

ASIAN INST. OF TECH., BANGKOK (THAILAND). DEPT. OF ENVIRONMENTAL ENGINEERING.
A Multiobjective Model for Regional Water Quality Management,
W79-09867 6A

AUBURN UNIV., AL. DEPT. OF CIVIL ENGINEERING.
A Study of the Permanent Effects of Elevated Temperature on the Hydraulic Properties of Clay,
W79-10022 8B

AUSTRALIAN NATIONAL UNIV., CANBERRA (AUSTRALIA). DEPT. OF GEOGRAPHY.
Experimental Control of Beach Face Dynamics by Watertable Pumping,
W79-09971 2L

BABCOCK AND WILCOX EXPANOLA S.A., MADRID (SPAIN).
Las Palmas Phase II Desalination Plant in the Canary Islands (Spain),
W79-09874 3A

BALFOUR (D.) AND SONS, LONDON (ENGLAND).
The Quality of Run-Off from an Irrigated Market Garden Area in Brazil,
W79-09985 5B

BATTELLE PACIFIC NORTHWEST LAB., SEQUIM, WA. MARINE RESEARC LAB.
A Morphological Defect in Shiner Perch Resulting from Chronic Exposure to Chlorinated Sea Water,
W79-09907 5C

BATTELLE PACIFIC NORTHWEST LABS., RICHLAND, WA.
Artificial Radionuclides,
W79-10054 5C

BENNETT POLLUTION CONTROLS LTD., VANCOUVER (BRITISH COLUMBIA). (ASSIGNEE).
V-Shaped Oil Containment Boom,
W79-09937 5G

BIOQUEST, COCKEYSVILLE, MD.
Quality Control of Membrane Filter Media,
W79-09884 7B

BUREAU OF RECLAMATION, PHOENIX, AZ.
Central Arizona Project RE:CAP, Information Packet No. 1.
W79-10060 8A

Central Arizona Project RE:CAP, Information Packet No. 2.
W79-10061 6C

Central Arizona Project RE:CAP, Information Packet No. 3.
W79-10062 5G

Central Arizona Project RE:CAP, Information Packet No. 4.
W79-10063 8A

Central Arizona Project RE:CAP, Information Packet No. 5.
W79-10064 6G

CALIFORNIA UNIV., RIVERSIDE. DEPT. OF SOIL AND ENVIRONMENTAL SCIENCES.
Boron Distribution in Soils and Waters of Egypt,
W79-10073 2K

CENTER FOR WATER RESOURCES DEVELOPMENT AND MANAGEMENT, TRIVANDRUM (INDIA).
An Analytical Solution for the Transient Ditch Drainage Problem,
W79-09984 2G

CENTRAL ARID ZONE RESEARCH INST., JODHPUR (INDIA).
Sprinkler in the Desert,
W79-10079 3F

CH2M/HILL, INC., CORVALLIS, OR.
Developing a Computer Program for Distribution System Analysis,
W79-09876 4A

CHEMICAL SYSTEMS, INC., TUSTIN, CA.
Development of Dry Process Microporous Polysulfone Supports for Ultrathin Film Composites,
W79-09839 3A

COLORADO STATE UNIV., FORT COLLINS. DEPT. OF AGRICULTURAL AND CHEMICAL ENGINEERING.
Procedure for the Economical Evaluation of Water Networks' Parameters,
W79-09866 6A

Estimating Sprinkler Distribution Patterns Using Linear Regression,
W79-09915 3F

COLORADO STATE UNIV., FORT COLLINS. NATURAL RESOURCE ECOLOGY LAB.
Response of Native Grassland Legumes to Water and Nitrogen Treatments,
W79-10071 2I

COMMONWEALTH SCIENTIFIC AND INDUSTRIAL RESEARCH ORGANIZATION, SYDNEY (AUSTRALIA). DIV. OF CLOUD PHYSICS.
A Cloud-Seeding Experiment in Tasmania,
W79-09963 2B

CONSTRUCTION ENGINEERING RESEARCH LAB. (ARMY), CHAMPAIGN, IL.
A Study of the Reuse of Reused Water,
W79-09846 3C

COOK COLL., NEW BRUNSWICK, NJ.
Simulation of Infiltration from a Continuous and an Intermittent Subsurface Source,
W79-09978 2G

CORNELL UNIV., ITHACA, NY. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
Reservoir Metalimnion Oxygen Demands: Discussion,
W79-09925 5C

DAMES AND MOORE, DENVER, CO. WATER POLLUTION CONTROL ENGINEERING SERVICES.
Construction Costs for Municipal Wastewater Treatment Plants: 1973-1977.
W79-10080 5D

DENVER UNIV., CO. DEPT. OF GEOGRAPHY.
The Prediction of Mean Monthly Soil Temperature from Mean Monthly Air Temperature,
W79-09906 2A

DEPARTMENT OF AGRICULTURE, OTTAWA (ONTARIO). SOIL RESEARCH INST.
Nitrogen and Chloride Leaching in a Sandy Field Plot,
W79-09911 2G

DEPARTMENT OF AGRICULTURE, SWIFT CURRENT (SASKATCHEWAN). RESEARCH STATION.
Computer Simulation Model for Predicting Soil Water Content Profiles,
W79-09977 2G

DEPARTMENT OF WATER AFFAIRS, PRETORIA (SOUTH AFRICA). HYDROLOGY, DIV.
Probability Distributions of Best Fit to South African Flood Data,
W79-09842 2E

DOMTAR INC., MONTREAL (QUEBEC). (ASSIGNEE).
Treatment of Mercury Contaminated Aqueous Media,
W79-10069 5D

EAST CAROLINA UNIV., GREENVILLE, NC. DEPT. OF BIOLOGY.
The Distribution and Seasonality of the Benthic Aquatic Macrophytes of the Pamlico River Estuary, North Carolina,
W79-09834 2L

ENVIRONMENTAL MONITORING AND SUPPORT LAB., CINCINNATI, OH.
The Membrane Filter Dilemma,
W79-09882 7B

ENVIRONMENTAL MONITORING AND SUPPORT LAB., LAS VEGAS, NV. MONITORING OPERATIONS DIV.
Distribution of Phytoplankton in Louisiana Lakes,
W79-10026 2H

Distribution of Phytoplankton in South Dakota Lakes,
W79-10027 2H

ENVIRONMENTAL PROTECTION AGENCY, KANSAS CITY, KS. SURVEILLANCE AND ANALYSIS DIV.
Efficiency of Coliform Recovery Using Two Brands of Membrane Filters,
W79-09891 7B

ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, DC. OFFICE OF WATER AND WASTE MANAGEMENT.
Influences of Hardness Constituents on the Acute Toxicity of Cadmium to Brook Trout (Salvelinus Fontinalis),
W79-09932 5C

ENVIRONMENTAL RESEARCH LAB., GULF BREEZE, FL.
Synthetic Organics,
W79-10050 5C

EXXON RESEARCH AND ENGINEERING CO., FLORHAM PARK, NJ. (ASSIGNEE).
Use of Microorganisms in Combination with Surface Active Agents to Synergistically Disperse Oil Slicks,
W79-09930 5G

FISH AND WILDLIFE SERVICE, ANCHORAGE, AK. OFFICE OF BIOLOGICAL SERVICES AND COASTAL ECOSYSTEMS.
Migration of Birds in Alaska Marine Habitats,
W79-10046 5C

FISH AND WILDLIFE SERVICE, LAUREL, MD. PATUXENT WILDLIFE RESEARCH CENTER.
Ecological and Physiological/Toxicological Effects of Petroleum on Aquatic Birds. A Summary of Research Activities FY 76 Through FY 78,
W79-10031 5C

FISHERIES AND MARINE SERVICE, WINNIPEG (MANITOBA). FRESHWATER INST.
Effects of Temperature and Cold Storage on Development Time and Viability of Eggs of the Burrowing Mayfly Hexagenia Rigida (Ephemeroptera: Ephemeridae),
W79-09919 5C

FLORIDA UNIV., GAINESVILLE.
Nationwide Cost of Wet-Weather Pollution Control,
W79-09858 6B

GENERAL ACCOUNTING OFFICE, WASHINGTON, DC. ENERGY AND MINERALS DIV.
Power Production at Federal Dams Could Be Increased by Modernizing Turbines and Generators.
W79-09991 8C

GEOLOGICAL SURVEY, RESTON, VA.
Use of Baker's Yeast to Trace Microbial Movements in Ground Water,
W79-09855 5B

GEORGIA INST. OF TECH., ATLANTA. SCHOOL OF CIVIL ENGINEERING.
Effect of Injury on the Recovery of Indicator Bacteria on Membrane Filters,
W79-09886 7B

GEORGIA UNIV., ATHENS.
Fluctuations in Naturally Occurring Populations of Enteric Bacteria in Oligotrophic Streams of Western North Carolina,
W79-09902 5A

GEORGIA UNIV., ATHENS. INST. OF NATURAL RESOURCES.
Budgets of Selected Natural Mineral Nutrients for a Southeastern Piedmont Forest and Pasture,
W79-09927 5C

GEORGIA UNIV., ATHENS. SCHOOL OF FOREST RESOURCES.
Consequences of Harvesting and Site Preparation in the Piedmont,
W79-09878 5A

GILBERT/COMMONWEALTH, READING, PA.
Computer Applications: A Tool for Water Distribution Engineering,
W79-09875 4A

GUELPH UNIV. (ONTARIO).
Time of Spread Relationship in Irrigation Check Basins,
W79-09917 2G

HELSINKI UNIV. (FINLAND). TVARMINNE ZOOLOGICAL STATION.
Factors Affecting the Burrowing Activity of Macoma Balthica (L.),
W79-09959 5C

HOUSTON UNIV., TX. DEPT. OF BIOPHYSICAL SCIENCES.
Alkanes in Seawater in the Vicinity of the Buccaneer Oilfield,
W79-09905 5B

HOWARD (CHARLES) AND ASSOCIATES LTD., WINNIPEG (MANITOBA).
An Analytic Approach to Scheduling Pipe Replacement,
W79-09879 6B

HYDROCOMP INC., PALO ALTO, CA.
User's Manual for Agricultural Runoff Management (ARM) Model,
W79-09904 5G

IDAHO STATE UNIV., POCATELLO. DEPT. OF BIOLOGY.
Autotrophy in Stream Ecosystems,
W79-09922 5C

IDAHO UNIV., MOSCOW.
Water Quality Characteristics of the Horse Creek Watersheds in North Central Idaho,
W79-09838 2A

Income Distribution Impacts of a Water Development Project--Boise Project, Idaho, 1950-1970,
W79-09865 6B

ILLINOIS STATE WATER SURVEY, PEORIA. WATER QUALITY SECTION.
Evaluation of Methods for Detecting Coliforms and Fecal Streptococci in Chlorinated Secondary Sewage Effluents,
W79-09897 7B

ILLINOIS UNIV. AT THE MEDICAL CENTER, CHICAGO. DEPT. OF BIOLOGICAL SCIENCES.
The Effect of Temperature on Copper Tolerance of Paramecium,
W79-09903 5C

INSTITUTE FOR MARINE ENVIRONMENTAL RESEARCH, PLYMOUTH (ENGLAND).
The Development of the Eggs and Early Larvae of Blue Whiting, Micromeisistius Poutassou, and the Effect of Temperature on Development,
W79-09942 5C

INSTITUTE OF MARINE RESEARCH, HELSINKI (FINLAND). BIOLOGICAL LAB.
Upper Limits of the Depth Range and Temperature Tolerance of the Baltic Pontoporeia Affinis (Crustacea, Amphipoda),
W79-09956 5C

INSTITUTT FOR ATOMENERGI, KJELLER (NORWAY).
Methodology of Studies on Chemical Processes in Water Runoff from Rock and Shallow Soil Cover Using Radioactive Tracers,
W79-09980 2K

INSTITUTUL DE CONSTRUCTII DIN BUCURESTI (ROMANIA). DEPT. OF SOIL MECHANICS AND FOUNDATION ENGINEERING.
Engineering Problems Associated with Expansive Clays from Romania,
W79-09972 2G

INTERMEDIATE TECHNOLOGY DEVELOPMENT GROUP, LONDON (ENGLAND).
Rural Water Development in Arid Regions,
W79-10065 6G

INTERNATIONAL INST. FOR APPLIED SYSTEMS ANALYSIS, LAXENBURG (AUSTRIA).
A Comparative Case Study of Dynamic Models for DO-BOD-Algae Interaction in a Freshwater River,
W79-09862 5A

IOWA STATE UNIV., AMES. ENGINEERING RESEARCH INST.
Engineering Management of Nuclear Desalination Plants--A Case Study, Saudi Arabia,
W79-09872 3A

JOHNS HOPKINS UNIV., BALTIMORE, MD. CHESAPEAKE BAY INST.
Dredging and Disposal of Its Large-Volume Waste,
W79-10052 5B

KANNERT GRADUATE SCHOOL OF MANAGEMENT, LAFAYETTE, IN.
Heuristic Decision Rules for Water Resources Planning,
W79-09962 6A

KONSTANZ (GERMANY, F.R.), LIMNOLOG INST.
Effects of Sudden Temperature Shifts on Pure Cultures of Four Strains of Freshwater Bacteria,
W79-09948 5C

LITTLE (ARTHUR D.), INC., CAMBRIDGE, MA. (ASSIGNEE).
Wastewater Treatment with Desorbing of an Adsorbate from an Adsorbent with a Solvent in the Near Critical State,
W79-09929 5D

LOUISIANA STATE UNIV., BATON ROUGE. COASTAL STUDIES INST.
Application of Infinite Slope Analysis to Subaqueous Sediment Instability, Mississippi Delta,
W79-09970 2L

LUND UNIV. (SWEDEN). LIMNOLOGICAL INST.
The Effects of Temperature and Different Food Organisms on the Rate of Gastric Evacuation in Perch (Perca Fluviatilis),
W79-09952 5C

LYON-1 UNIV., VILLEURBANNE (FRANCE). DEPT. DE BIOLOGIE ANIMAUX ET ZOOLOGIE.
The Influence of Some Ecological Factors on the Metabolism-Temperature Curve of the Larvae of Limnephilus Rhombicus, (Trichoptera, Limnephilidae),
W79-09953 5C

MACHINEFABRIEK GEURTSEN DEVENTER N.V., DEVENTER (NETHERLANDS). (ASSIGNEE).
Apparatuses to Separate a Mixture of Liquids of Different Specific Gravities, E.G. Oil and Water,
W79-10028 5G

MARATHWADA UNIV., AURANGABAD (INDIA). DEPT. OF ZOOLOGY.
Laboratory Studies on the Direct Effect of Temperature on the Freshwater Vector Snail, Indoplanorbis Exustus (Deshyes),
W79-09934 5C

MARYLAND UNIV., COLLEGE PARK. DEPT. OF CIVIL ENGINEERING.
Comparative Evaluation of Statistical Methods for Water Supply Forecasting,
W79-09870 2E

MARYLAND UNIV., COLLEGE PARK. DEPT. OF MICROBIOLOGY.
Comparison of Membrane Filter Counts and Plate Counts on Heterotrophic and Oil Agar Used to Estimate Populations of Yeast, Fungi and Bacteria,
W79-09900 7B

MASSACHUSETTS UNIV., WALTHAM. DEPT. OF ENVIRONMENTAL SCIENCES.
A Simplified Method for the Simulataneous Extraction of Phytoplanktonic Chlorophyll and Fecal Sterol from Water,
W79-09979 5A

MELBOURNE UNIV., PARKVILLE (AUSTRALIA). CENTRE FOR ENVIRONMENTAL STUDIES.
Water Quality Sampling Programs in Rivers,
W79-09859 5A

MELBOURNE WATER SCIENCE LABS. (AUSTRALIA).
Low Cost Methods of Treatment of Agricultural Effluents in Warm Climates,
W79-10068 5D

MEMORIAL UNIV. OF NEWFOUNDLAND, ST. JOHN'S. MARINE SCIENCES RESEARCH LAB.
Reduction of Blood Plasma Copper Concentrations in a Marine Fish Following a Six Month Exposure to Crude Oil,
W79-09931 5C

METCALF AND EDDY, INC., BOSTON, MA.
Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study: Summary Report,
W79-09992 5D

Wastewater Engineering and Management Plan for Boston Harbor - Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 1: Planning Criteria,
W79-09993 5G

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Management Area, EMMA Study, Volume 3B: Study of Wastes from Large Industries,
W79-09995 5B

Wastewater Engineering and Management Study for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 3A: Study of Certain Industrial Wastes.
W79-09996 5B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 4: Water Oriented Wastewater Disposal Concepts,
W79-09997 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 5: Land Oriented Wastewater Utilization Concepts,
W79-09998 5G

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 7: Combined Sewer Overflow Regulation,
W79-09999 5F

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Volume 9: MDC Interceptor and Pumping Station Analysis and Improvements.
W79-10001 8B

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, Emma Study, Technical Data Volume 10: Deer Island Wastewater Treatment Plant Analysis and Improvements.
W79-10002 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 11: Nut Island Wastewater Treatment Plant Analysis and Improvements.
W79-10003 5D

Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Volume 15: Recommended Plan and Implementation Program,
W79-10011 5D

METCALF AND EDDY, INC., BOSTON, MASS.
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts Metropolitan Area, EMMA Study, Technical Data Volume 2: Engineering Criteria,
W79-09994 8B

METEOROLOGY RESEARCH, INC., ALTADENA, CA.
Changes in Cloud Base Precipitation Particle Size-Distributions as a Response Variable to Seeding,
W79-10025 2B

MICHIGAN STATE UNIV., EAST LANSING.
Uncertainty Analysis Applied to Vollenweider's Phosphorus Loading Criterion,
W79-09856 5A

MICHIGAN STATE UNIV., EAST LANSING. DEPT. OF CROP AND SOIL SCIENCES.
Magnesium Uptake from Exchangeable and Nonexchangeable Sources in Soils as Measured by Intensive Cropping,
W79-09908 2I

MICHIGAN UNIV., ANN ARBOR. SCHOOL OF PUBLIC HEALTH.
Aspects of Environmental Health Impacts of the Aswan High Dam on Rural Population in Egypt,
W79-10066 6G

MICROBE ONE, ANN ARBOR, MI.
The ASTM Proposed Membrane Filter Test Frocedure for the Recovery of Fecal Coliforms,
W79-09898 7B

MILLIPORE CORP., BEDFORD, MA.
Statistical Interpretation of Membrane Filter Bacteria Counts,
W79-09885 7B

Optimum Membrane Stru tures for Growth of Fecal Coliform Organisms,
W79-09888 7B

MINISTRY OF AGRICULTURE AND WATER, RIYADH (SAUDI ARABIA).
The World's First Large Seawater Reverse Osmosis Desalination Plant, at Jeddah, Kingdom of Saudi Arabia,
W79-09873 3A

MINNESOTA UNIV., ST. PAUL.
Fertilizer Nitrogen Distribution Under Irrigation Between Soil, Plant, and Aquifer,
W79-10024 4B

MISSOURI UNIV.-ROLLA. DEPT. OF LIFE SCIENCE.
Effects of Temperature on the Recovery of Fecal Coliforms,
W79-09887 7B

MITTEX A.G., VADUZ (LIECHTENSTEIN).
Process and System for Recovering Water from the Atmosphere,
W79-09940 2A

MONASH UNIV., CLAYTON (AUSTRALIA). DEPT. OF ZOOLOGY.
Inputs and Outputs of Water and Phosphorus from Four Victoria Catchments,
W79-09921 5B

MONTANA STATE UNIV., BOZEMAN. DEPT. OF MICROBIOLOGY.
Comparison of Membrane Filters in Recovery of Naturally Injured Coliforms,
W79-09890 7B

Recovery Characteristics of Bacteria Injured in the Natural Aquatic Environment,
W79-09894 7B

MONTGOMERY (JAMES M.), INC., PASADENA, CA.
Can Off-Peak Pumping Cut Utility Power Costs,
W79-09860 4A

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, LANGLEY STATION. LANGLEY RESEARCH CENTER.
Monitoring the Temporal Dispersion of a Sewage Sludge Plume,
W79-10030 5C

NATIONAL ENVIRONMENTAL RESEARCH CENTER, CINCINNATI, OH. WATER SUPPLY RESEARCH LAB.
Performance Variability of Membrane Filter Procedures,
W79-09883 7B

NATIONAL INST. FOR WATER RESEARCH, PRETORIA (SOUTH AFRICA).
Water Analysis in South Africa: Interlaboratory Comparison Studies, Part IV: Mineral Analysis,
W79-09841 9C

The Chemical Composition of the Upper Hennops River and its Implications on the Water Quality of Rietvlei Dam,
W79-09843 5A

Disinfection of Water: Pros and Cons,
W79-09845 5D

Modeling Water Distribution in Santa Clara County, Calif.,
W79-09877 4A

NATIONAL MARINE FISHERIES SERVICE, AUKE BAY, AK. NORTHWEST AND ALASKA FISHERIES CENTER.
Intertidal Biota and Subtidal Kelp Communities of the Kodiak Island Area,
W79-10035 5C

Sorting and Identification of Intertidal Samples,
W79-10036 5C

NATIONAL MARINE FISHERIES SERVICE, MILFORD, CT. MILFORD LAB.
Trace Metal Uptake by Three Species of Mollusks,
W79-09933 5C

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WA. NORTHWEST AND ALASKA FISHERIES CENTER.
Levels and Sources of Critical Trace Metals in the Marine Environment,
W79-10040 5B

Acute Toxicity of Heavy Metals,
W79-10041 5C

Pathology of Arctic and Subarctic Marine Species and Exposure to Trace Metals Associated with Petroleum,
W79-10042 5C

Metabolism of Trace Metals: Bioaccumulation and Biotransformation in Marine Organisms,
W79-10043 5C

Behavioral and Physiological Effects Induced by Sublethal Levels of Heavy Metals,
W79-10044 5C

General Effects of Metals on the Ecosystem,
W79-10045 5C

NATIONAL MARINE FISHERIES SERVICE, SEATTLE, WA. NORTHWEST FISHERIES CENTER.
Baseline Studies of the Demersal Resources of the Eastern and Western Gulf of Alaska Shelf and Slope: A Historical Review,
W79-10037 5C

NATIONAL MARINE FISHERIES SERVICES HIGHLANDS, NJ. SANDY HOOK SPORT FISHERIES MARINE LAB.
Transient Effects of Ocean Wastewater Sludge Dumping,
W79-10029 5C

NATIONAL MARINE WATER QUALITY LAB., NARRAGANSETT, RI.
Comparison of Membrane Filter Brands for Recovery of the Coliform Group,
W79-09892 7B

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, SEATTLE, WA. PACIFIC MARINE ENVIRONMENTAL LAB.
Biostimulants,
W79-10057 5C

NATIONAL RESEARCH COUNCIL OF CANADA, OTTAWA (ONTARIO). DIV. OF BIOLOGICAL SCIENCES.
Pathways for Mercury Uptake by Fish from Bed Sediments,
W79-09918 5B

NEW HAMPSHIRE UNIV., DURHAM.
Distribution Patterns and Population Dynamics of Polyphemus Pediculus (L.) (Crustacea, Cladocera) in a Small New England Lake,
W79-09836 2H

NEW HAMPSHIRE UNIV., DURHAM. DEPT. OF EARTH SCIENCES.
Pattern of Ice Surface Lowering for Rennick Glacier, Northern Victoria Land, Antarctica,
W79-09974 2C

NEW MEXICO INST. OF MINING AND TECHNOLOGY, SOCORRO.
The Role of Computers in Transfer of Water Resource Technology,
W79-09853 6A

NEW MEXICO STATE UNIV., LAS CRUCES. DEPT. OF AGRONOMY.
Minimizing the Salt Burden of Irrigation Drainage Water in the Pecos Valley of New Mexico.
W79-09837 3B

NORSKE SKOGFORSOKSVESEN, OSLO.
Interaction Between Simulated Rain and Barren Rock Surface,
W79-09981 2K

NORTH TEXAS STATE UNIV., DENTON. DEPT. OF BIOLOGICAL SCIENCES.
Effects of Calcium Addition as Ca(NO3)2 on Zinc Toxicity to Fathead Minnows, Pimephales Promelas, Rafinesque,
W79-09928 5C

NORTHEASTERN FOREST EXPERIMENT STATION, PARSONS, WV.
Some Effects of Urea Fertilization on a Forested Watershed in West Virginia,
W79-09847 2K

Can Forest Land Produce Wood, Recreation, and High Quality Water Too,
W79-09851 4C

NORTHERN ILLINOIS UNIV., DEKALB. DEPT. OF GEOLOGY.
Elements of a Water Quality Information System for the State of Illinois,
W79-09869 5A

NUCLEAR RESEARCH CENTER, KARLSRUHE (GERMANY, F.R.).
On the Monetary Value of an Ecological River Quality Model,
W79-09863 6A

OAK RIDGE NATIONAL LAB., TN.
An Investigation of Plutonium Concentration and Distribution in a Burrowing Crayfish from the White Oak Creek Floodplain,
W79-09943 5C

An Empirical Model of Impingement Impact,
W79-09944 5C

Effect of a Steam Electric Generating Station on the Emergence Timing of the Mayfly, Hexagenia Bileneata,
W79-09949 5C

Effects of Water-Soluble Chlorine-Containing Organics on Aquatic Environments--Another Perspective,
W79-09954 5C

Toxicity of Gallium and Beryllium to Developing Carp Eggs (Cyprinus Carpio) Utilizing Copper as a Reference,
W79-09958 5C

Spatial Correlations of Monthly Rainfall: Applications in Climatology and Weather Modification Experiments,
W79-09964 2B

OCCIDENTAL COLL., LOS ANGELES, CA. DEPT. OF BIOLOGY.
Thermal Behavioral Responses of the Speckled Sanddab, Citharichthys Stigmaeus: Laboratory and Field Investigations,
W79-09945 5C

Thermal Behavioral Responses of Selected California Littoral Fishes,
W79-09946 5C

OKLAHOMA STATE UNIV., STILLWATER. DEPT. OF AGRONOMY.
Irrigation Water Conservation Using Wide-Spaced Furrows,
W79-10074 3F

ONTARIO MINISTRY OF HEALTH, TORONTO. LAB. SERVICES BRANCH.
A Comparison of Membrane Filters and Media Used to Recover Coliforms from Water,
W79-09889 7B

ORANGE COUNTY WATER DISTRICT, FOUNTAIN VALLEY, CA.
Water Factory 21 Design and Operating Data,
W79-09961 5D

OREGON STATE UNIV., CORVALLIS.
Soil Water Content and Temperature as Factors in the Volatile Loss of Applied Mercury (II) from Soils,
W79-09916 2K

PEAT, MARWICK, MITCHELL AND CO., BOSTON, MA.
Wastewater Engineering and Management Plan for Boston Harbor-Eastern Massachusetts, EMMA Study, Volume 12: Financing and Management, Parts 1 and 2,
W79-10004 6E

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF AGRICULTURAL ENGINEERING.
Infiltration of Liquid Dairy Manure into Soil,
W79-09965 5E

PENNSYLVANIA STATE UNIV., UNIVERSITY PARK. DEPT. OF VETERINARY SCIENCE.
A Comparison of Membrane Filters, Culture Media, Incubation Temperatures, Polluted Water and Escherichia Coli Strains in the Fecal Coliform Test,
W79-09893 7B

PERMUTIT CO., PRINCETON, NJ.
Pretreatment of Seawater for Reverse Osmosis Processes: 1976,
W79-09831 3A

PHILIPS GLOEILAMPENFABRIEKEN N.V., EINDHOVEN (NETHERLANDS). APPLICATION LAB.
Analysis of Nitrate Content of Surface Water and Effluent Water. Applications of a Plastic-Membrane Nitrate-Selective Electrode in Water Quality Monitors,
W79-09920 5C

POLISH ACADEMY OF SCIENCES, POZNAN. DEPT. OF AGROBIOLOGY.
Effects of Artificial Rise of Temperature on Stagnant Waters and Their Biocenoses,
W79-09960 5C

PORT ELIZABETH UNIV. (SOUTH AFRICA). DEPT. OF ZOOLOGY.
An Ecophysiological Study of the Meiofauna of the Swartkops Estuary. 3. Partition of Benthic Oxygen Consumption and the Relative Importance of the Meiofauna,
W79-09924 5C

PRINCETON UNIV., NJ. SCHOOL OF ENGINEERING AND APPLIED SCIENCE.
Analysis of Investments in Technology Development and Resource Conservation,
W79-09854 6B

PRO-TECH, INC., PAOLI, PA. (ASSIGNEE).
Flow Monitoring,
W79-09936 8B

PROCTER AND GAMBLE CO., CINCINNATI, OH.
Concentrations of Nitrilotriacetate and Certain Metals in Canadian Wastewaters and Streams: 1971-1975,
W79-09986 5B

PURDUE UNIV., LAFAYETTE, IN.
Cation Exchange Equilibria in Florida and Indiana Histosols,
W79-09912 2K

PURDUE UNIV., LAFAYETTE, IN. WATER RESOURCES RESEARCH CENTER.
Development of an Extension of ILLUDAS Model for Continuous Simulation of Urban Runoff Quantity and Discrete Simulation of Runoff Quality.
W79-09832 2A

READING UNIV. (ENGLAND). DEPT. OF SOIL SCIENCE.
Use of Fluorescent Dyes to Mark the Pathways of Solute Movement through Soils under Leaching Conditions: 1. Laboratory Experiments,
W79-09976 2G

RHODE ISLAND UNIV., KINGSTON.
Microorganisms,
W79-10055 5C

RHODE ISLAND UNIV., KINGSTON. GRADUATE SCHOOL OF OCEANOGRAPHY.
Fossil Fuel Compounds,
W79-10058 5C

RIJKSINSTITUUT VOOR DE VOLKSGEZOND-HEID, BILTHOVEN (NETHERLANDS).
Chlorophenols in Surface Waters of the Netherlands (1976-1977),
W79-09987 5A

ROOKEE UNIV. (INDIA). WATER RESOURCES DEVELOPMENT TRAINING.
Canal Seepage with Boundary at Finite Depth,
W79-09990 2G

ROSENSTIEL SCHOOL OF MARINE AND ATMOSPHERIC SCIENCE, MIAMI, FL.
Chlorination Products,
W79-10051 5C

RUTGERS - THE STATE UNIV., NEW BRUNSWICK, NJ. COLL. OF ENGINEERING.
Dispersion in the Upper Delaware Estuary,
W79-10021 2L

SAN DIEGO STATE UNIV., CA. DEPT. OF GEOLOGICAL SCIENCES.
Mid-Eocene Climatic Change, Southwestern California and Northwestern Baja California,
W79-10076 2B

Rainfall in Southern California,
W79-10078 2B

SARTORIUS MEMBRANE FILTER (GERMANY, F.R.).
Critique on ASTM Test for Recovery of Fecal Coliforms and Proposal for Modified Method,
W79-09899 7B

SCIENCE AND EDUCATION ADMINISTRATION, BRAWLEY, CA.
Predicting Irrigation Return Flow Rates,
W79-09913 3F

SCIENCE AND EDUCATION ADMINISTRATION, BRAWLEY, CA. IMPERIAL VALLEY CONSERVATION RESEARCH CENTER.
Drainage Practice in Imperial Valley,
W79-09910 3C

Salinity Profiles and Leaching Fractions for Slowly Permeable Irrigated Field Soils,
W79-10075 2G

SCIENCE AND EDUCATION ADMINISTRATION, FLORENCE, SC. COASTAL PLAINS SOIL AND WATER CONSERVATION RESEARCH CENTER.
Water Requirements and Water Table Variations for a Controlled and Reversible Drainage System,
W79-09966 2G

SCIENCE AND EDUCATION ADMINISTRATION, KIMBERLY, ID. SNAKE RIVER CONSERVATION RESEARCH CENTER.
The Role of Evapotranspiration Models in Irrigation Scheduling,
W79-09914 2D

SCIENCE AND EDUCATION ADMINISTRATION, MORRIS, MN. NORTH CENTRAL SOIL CONSERVATION RESEARCH CENTER.
Traveling Boom Sprinkler Operation in Wind,
W79-09967 3F

SCIENCE AND EDUCATION ADMINISTRATION, RIVERSIDE, CA. SALINITY LAB.
Infiltration as Influenced by Irrigation Water Quality,
W79-09989 5C

SCRIPPS INSTITUTION OF OCEANOGRAPHY, LA JOLLA, CA.
Growth, Feeding and Mortality of Larval and Early Postlarval Stages of the Oceanic Shrimp Sergestes Similis Hansen,
W79-09951 5C

SIEMENS A.G., MUNICH (GERMANY, F.R.). (ASSIGNEE).
Electrochemical Determination of Heavy Metals in Water and Apparatus Therefor,
W79-09935 5A

SOCIETE ANONYME D'ETUDES DE RECHERCHES ET DE PRODUCTIONS D'AGENTS CHIMIQUES, PARIS (FRANCE). (ASSIGNEE).
Process and Apparatus for Separating Matter in Suspension in a Liquid,
W79-09941 5D

SOIL CONSERVATION SERVICE, ORONO, ME.
Flood Hazard Analyses, Worthley Brook, Town of Poland, Maine, Androscoggin County,
W79-10014 2E

SOUTH CAROLINA UNIV., COLUMBIA. BELLE W. BARUCH INST. FOR MARINE BIOLOGY AND COASTAL RESEARCH.
The Freshwater Littoral Meiofauna in a South Carolina Reservoir Receiving Thermal Effluents,
W79-09950 5C

SOUTH DAKOTA UNIV., VERMILLION. DEPT. OF BIOLOGY.
Effect of Selenium Dioxide on the Accumulation and Acute Toxicity of Mercuric Chloride in Goldfish,
W79-09901 5C

SOUTHAMPTON UNIV. (ENGLAND). DEPT. OF GEOGRAPHY.
The Formation of Medial Moraines on Alpine Glaciers,
W79-09973 2C

SOUTHEASTERN FOREST EXPERIMENT STATION, FRANKLIN, NC. COWEETA HYDROLOGIC LAB.
Low Picloram Concentrations in Streamflow Resulting from Forest Application of Tordon-10K,
W79-09864 5B

State of the Art in Managing Water Resources on Forest Land,
W79-09880 3B

SOUTHERN CALIFORNIA COASTAL WATER RESEARCH PROJECT, EL SEGUNDO.
Trace Metals,
W79-10056 5C

SOUTHERN WATER AUTHORITY, EASTLEIGH (ENGLAND). DIRECTORATE OF RESOURCE PLANNING.
Lagoon Recharge of the Folkestone Beds at Hardham, Sussex--1972-75,
W79-09988 4B

STATE UNIV. OF NEW YORK AT STONY BROOK. COLL. OF ENGINEERING AND APPLIED SCIENCES.
A Land-Use Planning Model for Coastal Zone Management,
W79-10015 6A

STATE UNIV. OF NEW YORK AT STONY BROOK. MARINE SCIENCES RESEARCH CENTER.
Litter,
W79-10053 5B

SUDAN MEDICAL RESEARCH COUNCIL, KHARTOUM.
Studies on Natural Water Coagulants in the Sudan, with Special Reference to Moringa Oleifera Seeds,
W79-09844 5F

TECHNICAL UNIV. OF BUDAPEST (HUNGARY). DEPT. OF WATER MANAGEMENT.
Regulation Model of the Lake Velence Reservoir System,
W79-09852 6A

TELEDYNE INDUSTRIES, INC., FORT COLLINS, CO. (ASSIGNEE).

TELEDYNE INDUSTRIES, INC., FORT COLLINS, CO. (ASSIGNEE).
Water Control and Distribution Apparatus,
W79-10032 5G

Portable Water Filter,
W79-10077 5F

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY.
The Economic Value of Irrigation Water in the Western United States,
W79-10023 6B

TEXAS UNIV. AT AUSTIN. BUREAU OF ECONOMIC GEOLOGY.
Nitrogen-Isotope Ratio Studies of Soils and Groundwater Nitrate from Alluvial Fan Aquifers in Texas,
W79-09983 5B

TOA HARBOR WORKS CO., LTD., TOKYO (JAPAN). (ASSIGNEE).
Pump-Type Sludge Dredging Apparatus,
W79-10017 5E

UMEA UNIV. (SWEDEN). DEPT. OF ECOLOGICAL BOTANY.
Changes in the Aquatic Flora Along a Stretch of the River Umealven, N. Sweden, Following Hydroelectric Exploitation,
W79-09957 5C

UNIFIED FOOD CONTROL LAB., GUATEMALA CITY.
Mercury Contamination of Fish in Guatemala,
W79-09939 5C

UNIVERSITY OF SOUTHERN COLORADO, PUEBLO. DEPT. OF ANTHROPOLOGY.
Anthropological Investigations Near the Crest of the Continent, 1975-1978,
W79-09840 6G

UTAH STATE UNIV., LOGAN. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
A Mathematical Model of Stratified, Bidirectional Flow in Short Culverts,
W79-09835 2A

WASHINGTON UNIV., SEATTLE. DEPT. OF OCEANOGRAPHY.
Local and Mesoscale Influences on Nutrient Variability in the Northwest African Upwelling Region Near Cabo Corbeiro,
W79-09926 5C

WASHINGTON UNIV., SEATTLE. GEOPHYSICS PROGRAMS.
Grain Coarsening of Water-Saturated Snow,
W79-09975 2C

WATER REUSE PROMOTION CENTER, TOKYO (JAPAN).
Long Term Experiments on Sea Water Desalination at the Chigasaki Laboratory,
W79-09871 3A

WATERLOO UNIV. (ONTARIO). DEPT. OF BIOLOGY.
A Direct Observation Technique for the Study of Microorganisms in Sediment Samples,
W79-09982 2J

WATERLOO UNIV. (ONTARIO). DEPT. OF CIVIL ENGINEERING.
What Price, Reject Heat,
W79-09868 6C

WESSEX WATER AUTHORITY, BRISTOL (ENGLAND).
Management of Water in Wessex,
W79-09861 6A

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MA.
Biological Effects - A Generic View,
W79-10059 5C

WYOMING UNIV., LARAMIE. WATER RESOURCES RESEARCH INST.
Water Development in Wyoming: A Survey of Resident Attitudes, 1971,
W79-09833 6B

YALE UNIV., NEW HAVEN, CT. DEPT. OF EPIDEMIOLOGY AND PUBLIC HEALTH.
Nitrate Levels in Groundwater from the Fleuve, Senegal,
W79-10067 5A

YIN-LUNG YANG, KANGSHAN (TAIWAN). (ASSIGNEE).
System for Collecting Oil,
W79-09969 5G

ACCESSION NUMBER INDEX

W79-09831 3A
W79-09832 2A
W79-09833 6B
W79-09834 2L
W79-09835 2A
W79-09836 2H
W79-09837 3B
W79-09838 2A
W79-09839 3A
W79-09840 6G
W79-09841 9C
W79-09842 2E
W79-09843 5A
W79-09844 5F
W79-09845 5D
W79-09846 3C
W79-09847 2K
W79-09848 4A
W79-09849 6A
W79-09850 6A
W79-09851 4C
W79-09852 6A
W79-09853 6A
W79-09854 6B
W79-09855 5B
W79-09856 5A
W79-09857 6A
W79-09858 6B
W79-09859 5A
W79-09860 4A
W79-09861 6A
W79-09862 5A
W79-09863 6A
W79-09864 5B
W79-09865 6B
W79-09866 6A
W79-09867 6A
W79-09868 6C
W79-09869 5A
W79-09870 2E
W79-09871 3A
W79-09872 3A
W79-09873 3A
W79-09874 3A
W79-09875 4A
W79-09876 4A
W79-09877 4A
W79-09878 5A
W79-09879 6B
W79-09880 3B
W79-09881 7B
W79-09882 7B
W79-09883 7B
W79-09884 7B
W79-09885 7B
W79-09886 7B
W79-09887 7B
W79-09888 7B
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W79-09894 7B
W79-09895 7B
W79-09896 7B
W79-09897 7B
W79-09898 7B
W79-09899 7B
W79-09900 7B
W79-09901 5C
W79-09902 5A
W79-09903 5C
W79-09904 5G
W79-09905 5B
W79-09906 2A
W79-09907 5C
W79-09908 2I
W79-09909 2G
W79-09910 3C
W79-09911 2G
W79-09912 2K
W79-09913 3F
W79-09914 2D
W79-09915 3F
W79-09916 2K
W79-09917 2G
W79-09918 5B
W79-09919 5C
W79-09920 5C
W79-09921 5B
W79-09922 5C
W79-09923 5C
W79-09924 5C
W79-09925 5C
W79-09926 5C
W79-09927 5C
W79-09928 5C
W79-09929 5D
W79-09930 5G
W79-09931 5C
W79-09932 5C
W79-09933 5C
W79-09934 5C
W79-09935 5A
W79-09936 8B
W79-09937 5G
W79-09938 8A
W79-09939 5C
W79-09940 2A
W79-09941 5D
W79-09942 5C
W79-09943 5C
W79-09944 5C
W79-09945 5C
W79-09946 5C
W79-09947 5D
W79-09948 5C
W79-09949 5C
W79-09950 5C
W79-09951 5C
W79-09952 5C
W79-09953 5C
W79-09954 5C
W79-09955 5F
W79-09956 5C
W79-09957 5C
W79-09958 5C
W79-09959 5C
W79-09960 5C
W79-09961 5D
W79-09962 6A
W79-09963 2B
W79-09964 2B
W79-09965 5E
W79-09966 2G
W79-09967 3F
W79-09968 4A
W79-09969 5G
W79-09970 2L
W79-09971 2L
W79-09972 2G
W79-09973 2C
W79-09974 2C
W79-09975 2C
W79-09976 2G
W79-09977 2G
W79-09978 2G
W79-09979 5A
W79-09980 2K
W79-09981 2K
W79-09982 2J
W79-09983 5B
W79-09984 2G
W79-09985 5B
W79-09986 5B
W79-09987 5A
W79-09988 4B
W79-09989 5C
W79-09990 2G
W79-09991 8C
W79-09992 5D
W79-09993 5G
W79-09994 8B
W79-09995 5B
W79-09996 5B
W79-09997 5D
W79-09998 5G
W79-09999 5F
W79-10000 5F
W79-10001 8B
W79-10002 5D
W79-10003 5D
W79-10004 6E
W79-10005 6G
W79-10006 6C
W79-10007 6B
W79-10008 5F
W79-10009 6B
W79-10010 6B
W79-10011 5D
W79-10012 2E
W79-10013 2E
W79-10014 2E
W79-10015 6A
W79-10016 6E
W79-10017 5E
W79-10018 3F
W79-10019 6B
W79-10020 5G
W79-10021 2L
W79-10022 8B
W79-10023 6B
W79-10024 4B
W79-10025 2B
W79-10026 2H
W79-10027 2H
W79-10028 5G
W79-10029 5C
W79-10030 5C
W79-10031 5C
W79-10032 5G
W79-10033 5C
W79-10034 5C
W79-10035 5C
W79-10036 5C
W79-10037 5C
W79-10038 5C
W79-10039 5C
W79-10040 5B
W79-10041 5C
W79-10042 5C
W79-10043 5C
W79-10044 5C
W79-10045 5C
W79-10046 5C
W79-10047 5C
W79-10048 5C
W79-10049 5A
W79-10050 5C
W79-10051 5C
W79-10052 5B
W79-10053 5B
W79-10054 5C
W79-10055 5C
W79-10056 5C
W79-10057 5C
W79-10058 5C
W79-10059 5C
W79-10060 8A
W79-10061 6C
W79-10062 5G
W79-10063 8A
W79-10064 6G
W79-10065 6G
W79-10066 6G
W79-10067 5A
W79-10068 5D
W79-10069 5D
W79-10070 3F
W79-10071 2I
W79-10072 3A
W79-10073 2K
W79-10074 3F
W79-10075 2G
W79-10076 2B
W79-10077 5F
W79-10078 2B
W79-10079 3F
W79-10080 5D

TELEDYNE INDUSTRIES, INC., FORT COLLINS, CO. (ASSIGNEE).

TEXAS A AND M UNIV., COLLEGE STATION. DEPT. OF AGRICULTURAL ECONOMICS AND RURAL SOCIOLOGY.
The Economic Value of Irrigation Water in the Western United States.
W79-09833 6B

TEXAS UNIV., AUSTIN. BUREAU OF ECONOMIC GEOLOGY.
Stratigraphic Basis Studies of Soils and Groundwater Waters from Alluvial Fan Aquifers in Texas.
W79-09981 6B

TOA RUBBER WORKS CO., LTD., TOKYO (JAPAN). FASHION DEPT.
Pump Type Sludge Dredging Apparatus.
W79-09887 8C

UMEA UNIV., SWEDEN. DEPT. OF ECOLOGICAL BOTANY.
Changes in the Aquatic Flora Along a Stretch of the River Umeaelven, N. Sweden Following Hydroelectric Exploitation.
W79-09861 5C

UNITED FOOD CONTROL LAB., GUATEMALA CITY.
Microbiological Examination of Fish in Guatemala.
W79-09795 5C

UNIVERSITY OF SOUTHERN COLORADO, PUEBLO. DEPT. OF ANTHROPOLOGY.
Archeological Investigations Near the Confluence of the Colorado, 1976-1978.
W79-09940 6G

UTAH STATE UNIV., LOGAN. DEPT. OF CIVIL AND ENVIRONMENTAL ENGINEERING.
A Mathematical Model of Stratified Estuarine Circulation in Bear River Bay.
W79-09882 2A

WASHINGTON UNIV., SEATTLE. DEPT. OF OCEANOGRAPHY.
Land and Ocean Air Influences on Seasonal Variations in the Northeast Pacific Ocean.
W79-09939 5C

WASHINGTON, UNIV., SEATTLE. LIMNOLOGY AND WATER RESOURCES.
Water Conditions in Western States.
W79-09941 6B

WATER RESEARCH FOUNDATION CENTER, TOKYO (JAPAN).
Large Type Experiment on Ion Beam Treatment Equipment.
W79-09871 5D

WATERLOO UNIV., ONTARIO. DEPT. OF BIOLOGY.
A Diurnal Observation Technique for the Measurement of Benthic Oxygen Consumption.
W79-09981 5A

WATERLOO UNIV., ONTARIO. DEPT. OF CIVIL ENGINEERING.
Wind Driven Surface Drift.
W79-09884 2E

WEBBER WATER AUTHORITY, BRADFORD (ENGLAND).
Management of Water in Britain.
W79-09981 6A

WOODS HOLE OCEANOGRAPHIC INSTITUTION, MASS.
Surface Circulation Patterns in the Oceans.
W79-09917 2E

WYOMING WATER RESEARCH CENTER, LARAMIE.
Research Activities 1978-1979.
W79-09923 9C

WYOMING WATER RESEARCH INST., LARAMIE.
Wyoming Water Problems: A Survey.
W79-09922 6B

YALE UNIV., NEW HAVEN, CT. DEPT. OF EPIDEMIOLOGY AND PUBLIC HEALTH.
Nitrogen Isotope Fractionation from the Florida Everglades.
W79-09929 5B

YORKSHIRE WATER AUTHORITY, LEEDS (ENGLAND).
Yorkshire Water Authority Annual Report and Accounts 1978-79.
W79-09930 6A

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
A. CENTERS OF COMPETENCE		
Colorado State University, Irrigation Return Flow Quality	W79-09904, 09906 09908—09917	12
Cornell University, Policy Models for Water Resources Systems	W79-09848—09850 09852—09863 09865—09877 09879	29
DOE Oak Ridge National Laboratory, Nuclear Radiation and Safety	W79-09901, 09903 09905, 09907 09918—09919 09928 09931—09934 09939 09942—09946 09948—09954 09956—09960	29
Franklin Institute (FIRL), Municipal and Industrial Wastewater Treatment Technology	W79-09881—09900	20
Illinois State Water Survey, Hydrology	W79-09846 09963—09968 09970—09991	29
University of Arizona, Arid Land Water Resources	W79-10060—10068 10070—10071 10073—10076 10078—10079	17
University of N. Carolina, Metropolitan Water Resources Planning and Management	W79-09992—10016 10019—10020	27
University of Wisconsin, Eutrophication	W79-09920—09927	8
University of Wisconsin, Water Resources Economics	W79-10080	1

ABSTRACT SOURCES

SOURCE	ACCESSION NUMBER	TOTAL
B. STATE WATER RESOURCES RESEARCH INSTITUTES	W79-09833--09837 09962 10021--10024	10
C. OTHER		
Forest Service (USDA)	W79-09847, 09851 09864, 09878 09880, 09902	6
Information Planning Associates, Inc.	W79-09838--09845 10025--10027	11
Ocean Engineering Infor. Service (Patents)	W79-09929--09930 09935--09938 09940--09941 09947, 09955 09969 10017--10018 10028, 10032 10069, 10072 10077	18
Ocean Engineering Infor. Service (Outer Continental Shelf)	W79-10029--10031 10033--10059	30
Office of Water Research and Technology	W79-09831--09832 09961	3

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CENTERS OF COMPETENCE AND THEIR SUBJECT COVERAGE

- Ground and surface water hydrology at the Illinois State Water Survey.
- Metropolitan water resources planning and management at the Center for Urban and Regional Studies of University of North Carolina.
- Eastern United States water law at the College of Law of the University of Florida.
- Policy models of water resources systems at the Department of Water Resources Engineering of Cornell University.
- Water resources economics at the Water Resources Center of the University of Wisconsin.
- Eutrophication at the Water Resources Center of the University of Wisconsin.
- Water resources of arid lands at the Office of Arid Lands Studies of the University of Arizona.
- Water well construction technology at the National Water Well Association.
- Water related aspects of nuclear radiation and safety at the Oak Ridge National Laboratory.
- Water resource aspects of the pulp and paper industry at the Institute of Paper Chemistry.

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- Effect on water quality of irrigated return flows at the Department of Agricultural Engineering of Colorado State University.
- Agricultural livestock waste at East Central State College, Oklahoma.
- Municipal wastewater treatment technology at the Franklin Institute Research Laboratories.

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Office of Water Research and Technology	W79-09831--09832 09961	3

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Subject Fields

1 NATURE OF WATER

2 WATER CYCLE

3 WATER SUPPLY AUGMENTATION AND CONSERVATION

4 WATER QUANTITY MANAGEMENT AND CONTROL

5 WATER QUALITY MANAGEMENT AND PROTECTION

6 WATER RESOURCES PLANNING

7 RESOURCES DATA

8 ENGINEERING WORKS

9 MANPOWER, GRANTS, AND FACILITIES

10 SCIENTIFIC AND TECHNICAL INFORMATION

INDEXES

- SUBJECT INDEX
- AUTHOR INDEX
- ORGANIZATIONAL INDEX
- ACCESSSION NUMBER INDEX
- ABSTRACT SOURCES

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